

TABLE OF CONTENTS

	<u>Page</u>
1.0 OBJECTIVE	1-1
1.1 PURPOSE	1-1
1.2 PROGRAM OBJECTIVES	1-2
1.3 ORGANIZATION OF THE DECISION DOCUMENT	1-4
2.0 PROCESS OVERVIEW AND ORGANIZATION	2-1
2.1 PROCESS OVERVIEW	2-1
2.2 PROJECT ORGANIZATION	2-4
3.0 ALTERNATIVE ACTIONS	3-1
3.1 SELECTIVE EXCAVATION	3-1
3.2 SMALL VOLUME REMOVAL	3-3
3.3 CAPS AND COVERS	3-4
3.3.1 Concrete or Asphalt Caps	3-4
3.3.2 Maintenance of Concrete and Asphalt Caps	3-5
3.3.3 Vegetated Soil Covers	3-5
3.3.4 Maintenance of Vegetated Soil Covers	3-7
4.0 CRITERIA FOR REMEDY SELECTION	4-1
4.1 BASIC DATA REQUIREMENTS	4-1
4.2 EXCAVATION AND COVERS	4-2
4.3 REMEDY SELECTION PROCESS	4-3
5.0 POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) AND TO-BE-CONSIDERED GUIDANCE (TBCs)	5-1
5.1 INTRODUCTION	5-1
5.2 AMBIENT OR CHEMICAL-SPECIFIC ARARS	5-3
5.3 LOCATION-SPECIFIC ARARS	5-3
5.4 ACTION-SPECIFIC ARARS	5-4
5.5 DEPARTMENT OF ENERGY ORDERS	5-11
5.6 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)	5-13
6.0 RISK EVALUATION METHODOLOGY	6-1
6.1 RISK ASSESSMENT FOR IM/IRA	6-1
6.2 ROLE OF RISK ASSESSMENT IN THE IM/IRA PROCESS	6-1
6.3 IDENTIFICATION OF POTENTIAL CONTAMINANTS OF CONCERN	6-2
6.4 QUANTIFYING POTENTIAL RISKS FOR IM/IRA	6-3
6.5 RISK MANAGEMENT IN THE RISK ASSESSMENT PROCESS	6-5

46253

DRAFT FINAL

**DECISION DOCUMENT
SOIL REMEDIATION IM/IRA
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE**

September 1994

**EG&G Rocky Flats, Inc.
P.O. Box 464
Golden, Colorado 80402-0464**

ADMIN REC CRD

SW-A-003551

1187

TABLE OF CONTENTS, (Continued)

7.0 WASTE MANAGEMENT	7-1
7.1 HANDLING OF WASTE FROM SOIL IM/IRAS	7-1
7.2 STORAGE/DISPOSAL OPTIONS FOR WASTE FROM SOILS IM/IRAS	7-2
7.3 MANAGING FIELD DECONTAMINATION WASTES	7-2
8.0 DOCUMENTATION	8-1
8.1 IMPLEMENTATION DOCUMENTS	8-1
8.2 COMPLETION DOCUMENTS	8-4
8.3 MONTHLY REPORTING	8-5
9.0 EPA, STATE & PUBLIC COMMENTS	9-1
10.0 RESPONSIVENESS SUMMARY	10-1
11.0 REFERENCES	11-1

LIST OF APPENDICES

<u>Appendix</u>	<u>Title</u>
A	Specifications and Procedures
B	Sampling and Analysis Requirements
C	Federal and State Applicable or Relevant and Appropriate Requirements (ARARs)
D	Programmatic Risk-Based Preliminary Remediation Goals
E	Waste Management Procedures

LIST OF FIGURES

<u>Figure No.</u>	<u>Title</u>
2-1	Project Process Flowchart
2-2	Organization Chart
2-3	Site Management
3-1	Vegetated Soil Cover

LIST OF TABLES

<u>Table No.</u>	<u>Title</u>
3-1	Inspection Checklist for Soil Vegetative Covers
8-1	Soil Remediation IM/IRA Implementation Document Outline

LIST OF ACRONYMS

$\mu\text{g}/\text{m}^3$	micrograms per cubic meter
ARAR	Applicable or Relevant and Appropriate Requirements
BOM	Bill of Material
CAB	Citizens Advisory Board
CBOM	Construction Bill of Material
CC	Construction Coordinator
CCR	Colorado Code of Regulations
CDH	Colorado Department of Health
CE	Construction Engineer
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CM	Construction Management
COC	Contaminants of Concern
D&D	Decontamination & Decommission
dB	decibels
DCG	Derived Concentration Guidelines
DOE	Department of Energy
DOE-RFFO	Department of Energy - Rocky Flats Field Office
DQO	Data Quality Objective
EA	Environmental Assessment
EIS	Environmental Impact Statement
EM	Environmental Management
EPA	Environmental Protection Agency
ER	Environmental Restoration
ERM	Environmental Restoration Management
FE	Facilities Engineering
FIDLER	Field Instrument for Detection of Low-Energy Radiation
FS/CMS	Feasibility Study/Corrective Measures Study
GRRASP	General Radiochemistry and Routine
H&S	Health and Safety
HQ	Hazard Quotient
HSP	Health and Safety Practices
HSWA	Hazardous and Solid Waste Amendments
HWA	Hazardous Waste Act
IAG	InterAgency Agreement
IDM	Investigative Derived Material
IH	Industrial Hygienist
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/Interim Remedial Action

LIST OF ACRONYMS, (Continued)

IWCP	Integrated Work Control Process
LFI	Limited Field Investigation
LLM	Low-Level Mixed Waste
LLW	Low-Level Waste (radioactive)
MAC	Maintenance Action Center
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NFA	No Further Action
NTS	Nevada Test Site
OM	Operations Manager
OSHA	Occupational Safety and Health Act
OU	Operable Unit
OVA	Organic Vapor Analyzer
PA	Protected Area
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PCOC	Potential Contaminants of Concern
PEA	Potential Early Action
PMT	Post-Maintenance Testing
PPCD	Plant for Prevention of Contaminant Dispersal
PPE	Personal Protective Equipment
PRG	Preliminary Remediation Goal
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RE	Radiological Engineering
RFEDS	Rocky Flats Environmental Database System
RFETS	Rocky Flats Environmental Technology Site
RFI/CMS	RCRA Facility Investigation/Corrective Measures Study
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SDAF	Soil Disturbance Approval Form
SDEF	Soil Disturbance Evaluation Form
SOP	Standard Operating Procedure
SSDF	Site Survey Determination Form
SVR	Small Volume Removal
SWDA	Solid Waste Disposal Act
SWP	Standard Work Package
TAL	Target Analyte list
UTL	Upper Tolerance Limits
UV	Ultraviolet (radiation)
VOC	Volatile Organic Compound

LIST OF ACRONYMS, (Continued)

WAC	Waste Acceptance Criteria
WCF	Work Control Form
WP	Work Package
WPCL	Work Package Change Log
WSRIC	Waste Stream Identification and Characterization

1.0 OBJECTIVE

1.1 PURPOSE

The intent of the Soil Remediation IM/IRA program is to accelerate the cleanup process and reduce overall remediation costs without compromising the protection of either human health or the environment. The Soil Remediation IM/IRA program will excavate and/or cap selected contaminated soils at Individual Hazardous Substance Sites (IHSS) at Rocky Flats Environmental Technology Site (RFETS) where the type, nature, and extent of soil contamination have been sufficiently characterized to show that there is beneficial risk reduction and significant cost savings to be gained through an accelerated cleanup. This Decision Document describes the methodology to be used to implement this program.

This program will be implemented as an Interim Measure/Interim Remedial Action (IM/IRA) which is defined in the 1989 InterAgency Agreement (IAG or Agreement) between CDH, DOE, and EPA. The IM/IRA process has been selected because it permits appropriate and consistent remediation to occur prior to completion of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation/Feasibility Study (RI/FS) or a Resource Conservation and Recovery Act (RCRA) Facility Investigation/Corrective Measures Study (RFI/CMS). The main features which differentiate an IM/IRA from an RI/FS or a RFI/CMS are:

- A limited number of alternatives are evaluated,
- A complete baseline risk assessment is not required, and,
- Documentation is minimized.

IM/IRA actions are not inherently final actions since the performance and effectiveness of completed IM/IRAs is considered in developing Record of Decision (ROD). The Rocky Flats IM/IRA process is described in the Rocky Flats IAG. Therefore, any action taken under an

IM/IRA is action taken under the IAG. IM/IRA requirements are provided in the IAG in Chapter I, Sections 15 and 150, and in the Statement of Work, Section I.B.10. These requirements are proposed to be applied on a sitewide basis by agreement of the Parties (EPA, State and DOE) to this IM/IRA.

This Soil Remediation IM/IRA program is part of a comprehensive effort to accelerate the cleanup of the Rocky Flats Environmental Technology Site. This accelerated cleanup program is described and will be implemented by the following documents:

- SPIRIT Plan (EG&G, February 1994);
- DOE Letter to CDH and EPA to initiate an Accelerated Cleanup Process (June 1994)
- IHSS Screening and Categorization Process (ICF KE, 1994);
- This document (Soil Remediation IM/IRA Decision Document);
- Implementation Documents for Soil Remediation IM/IRA; and
- Completion Reports.

This Decision Document contains the requirements for implementing Soil Remediation IM/IRAs, including the data which are necessary for inclusion of an IHSS in the program, criteria which are considered in the selection of an action, applicable or relevant and appropriate requirements (ARARs), preliminary remediation goals (PRGs) and action levels, waste management requirements, specifications, and documentation requirements.

1.2 PROGRAM OBJECTIVES

The overall objectives of the Soil Remediation IM/IRA are as follows:

- To be protective of human health and the environment;
- To be cost effective and timely in execution;

- To select actions which will be consistent with the final remedy for the Operable Unit (OU); and
- To comply with ARARs.

Features which have been incorporated into the Soil Remediation IM/IRA to meet these goals are:

- Use of sitewide contamination threshold criteria;
- Excavation and/or capping of contaminated soils above contamination threshold criteria. These actions will eliminate exposure pathways and reduce mobility of contaminants in all media;
- Placing a number of similar, technologically simple, actions under the same program. Like actions (i.e., soil excavation and covers) have been consolidated under a single IM/IRA and are not restricted by OU boundaries. This approach will reduce stakeholder resource requirements, will benefit from economies of scale, will readily incorporate lessons learned and will reduce repetitive report generation and review;
- Using vegetated soil covers where hardened covers are not required. This cover design takes full advantage of Colorado's arid climate and annual precipitation distribution to use evapotranspiration from plants to prevent infiltration of precipitation from mobilizing contaminants in soils under the covers. These covers are much easier to design, construct and maintain than covers using vent systems, layers of clay, synthetic infiltration barriers and drainage materials, soils and vegetation. Vegetated soil covers, like more complex covers and caps, prevent human and biota contact with contaminants in soils;
- Document review times for all stakeholders will be optimized by limiting the number and length of documents to be produced;
- An NFA process will be developed and used to remove soils from further consideration at sites where there is no indication that soil contamination exists and where there is no risk to human health and the environment.
- Close coordination with OU management personnel to ensure that selected actions will be consistent with the final ROD for the OU.
- PRGs will be used as a screening tool for triggering action under the IM/IRA, rather than completing an individual risk assessment for each site.

- National Environmental Policy Act (NEPA) values for Soil Remediation IM/IRAs will be incorporated into the program and documents. It is presumed that the federal actions taken as part of this program are in substantive compliance with NEPA by adhering to the requirements of the National Contingency Plan (NCP), CERCLA and RCRA as necessary.
- The use of a team approach for execution of IM/IRAs. Team leaders have been chosen within the various Rocky Flats organizations to aid in expediting required approvals and permits.

These goals and actions are consistent with the recommendations presented in the current plan for accelerating remedial actions at Rocky Flats (EG&G, 1994).

1.3 ORGANIZATION OF THE DECISION DOCUMENT

This Decision Document contains the requirements for implementing Soil Remediation IM/IRAs. Section 2.0 provides an overview of the Soil Remediation IM/IRA process and the proposed project organization. Section 3.0 describes the alternative actions included in the Soil Remediation IM/IRA program. The criteria that will be used for selecting an alternative action at a specific site is discussed in Section 4.0. ARARs and risk evaluation methodology are discussed in Sections 5.0 and 6.0 respectively. A discussion of how wastes from Soil Remediation IM/IRA actions will be managed is included in Section 7.0. Section 8.0 describes the contents of the Implementation Documents and Completion Documents that are part of the Soil Remediation IM/IRA program. Sections 9.0 and 10.0 will include EPA, State, and Public comments and responses. Finally, applicable references are included in Section 11.0.

Also included are a number of appendices that provide additional information. The specification and procedures used for implementing the Soil Remediation IM/IRA are included in Appendix A. Appendix B provides details on sampling and analysis. A summary of ARARs is included in Appendix C. The Programmatic Risk-Based Preliminary Remediation Goals are included in Appendix D. Finally, procedures for managing wastes resulting from the Soil Remediation IM/IRA are included in Appendix E.

2.0 PROCESS OVERVIEW AND ORGANIZATION

2.1 PROCESS OVERVIEW

This Decision Document creates a process for expedited cleanup or resolution of environmental concerns regarding soil contamination at individual IHSSs. Potential actions which may be taken under the program are:

1. Small Volume Removal,
2. Selective Excavation, or
3. Capping or covering contaminated soils.

A methodology for selection of candidate sites is presented, as are a limited range of potentially applicable technologies. Finally, there is a mechanism created for implementation of the remedial action, together with verification sampling and documentation of the action. Each of these facets of the program is briefly described in this section. The process is also summarized on Figure 2-1.

Potential candidate sites will be selected by the OU Manager using the following criteria:

- Adequacy of available, validated environmental data,
- Current (pre-remediation) health and environmental risk,
- Potential for contaminant migration,
- Availability of soil storage, treatment, and disposal capacity,
- Compatibility with future OU remedial actions,
- Implementability of the action described in this Decision Document,
- Effectiveness of the action, and
- Achievement of ARARs.

Figure 2-1

Sites will then be categorized as candidates for Potential Early Actions (PEAs), as candidates for NFAs, or as inappropriate sites for this process. This screening and categorization process is described by ICF Kaiser Engineers (1994). IHSSs with insufficient characterization data as specified in Section 4.0 and Appendix B may only require Limited Field Investigations (LFI) prior to their inclusion in the IM/IRA process. LFIs will be completed under the direction of the OU manager for the site.

PEA candidate sites selected for inclusion in the Soil Remediation IM/IRA will be those that can be remediated with limited excavation, cover placement, or a combination of both. Candidates for excavation under the Soil Remediation IM/IRA will consist of areas with contaminated soil volumes of less than 500 cubic yards. Confirmatory sampling will be performed in all excavations for verification that the action has met IM/IRA standards.

No size limitations are contemplated for actions involving capping. Candidate areas may be contaminated with hazardous and/or radioactive constituents and must present a risk to potential receptors of either $>10^{-4}$ for cancer or >1.0 for non-cancer hazard index based upon the risk screening approach described in Section 6.0.

Small volumes (less than 5 cubic yards) of contaminated soil may be excavated and disposed/stored without issuance of an Implementation Document or other form of regulatory approval. These actions will be performed in accordance with procedures established in this Decision Document.

Excavated materials will be placed in permitted storage, for future treatment and/or off site disposal as appropriate. To the maximum extent practicable, these actions will meet ARARs, but are not necessarily the final actions for remediation of the IHSSs.

The specific action to be performed at each candidate site will be detailed in an Implementation Document. The Implementation Document will contain a brief summary of the applicable

environmental data, a recommended action, and an explanation of how the proposed action meets the criteria set forth in the Decision Document. Final drawings, and specifications will also be included in the Implementation Document.

A Completion Report will be prepared for each action (including small volumes) after all work is complete and the confirmatory sampling data have been validated. The report will consist of a brief description of the work performed, confirmatory sampling conducted, analytical results and exceptions to the original plan. DOE will prepare monthly progress reports to keep EPA and the State and plant representative apprised of progress in implementing the IM/IRA.

2.2 PROJECT ORGANIZATION

The project organization is designed to complement and fully integrate with the existing Environmental Restoration (ER) organization at Rocky Flats. As is shown in Figure 2-2, the project will be managed by EG&G's Environmental Restoration Management (ERM) group under the direction of DOE Rocky Flats Field Office (DOE-RFFO). The OU Managers will select candidates for early removal or capping actions which are compatible with ongoing and future programs in the OU and integrate completed IM/IRA results back into the Feasibility Study/Corrective Measures Study (FS/CMS) process. The OU Manager and the Soil Remediation IM/IRA Manager will work closely together to ensure that the IM/IRA action is consistent with the overall OU remediation strategy.

In order to streamline project review and execution, each major organization on plant site will have a designated Soil Remediation IM/IRA contact. The responsibility of this team (Figure 2-3) is to expedite information transfer, comment submittal, permitting and decision making related to the program on site. These representatives will be fully briefed on the intent of the program and will be kept apprised of project developments as necessary.

Figure 2-2

Figure 2-3

The Soil Remediation IM/IRA Manager will be responsible for the actual execution of the program including:

- coordination with the OU Manager and plant organizations;
- preparation of work plans, budgets, and schedules;
- preparation and modification of Implementation Documents;
- preparation of closure documents; and
- transfer of all data and documents back to the OU Manager upon completion.

The Soil Remediation IM/IRA Manager may be assisted by other EG&G staff and subcontractors as needed.

3.0 ALTERNATIVE ACTIONS

This section provides a discussion of the four alternatives which are considered under the Soil Remediation IM/IRA, namely:

- Small Volume Removal,
- Selective Excavation, and
- Covers.

Appendix A contains detailed specifications and procedures for the execution of these alternatives.

3.1 SELECTIVE EXCAVATION

Candidates for excavation under the Soil Remediation IM/IRA will be areas with contaminated soil volumes which can be remediated without the use of in-situ treatment (e.g. soil vapor extraction, and in-situ stabilization). A 500 cubic yard excavation limit has been selected as the practical maximum volume which can be excavated without considering a broader range of alternative remedial actions.

The depth of excavation will generally not exceed 4 feet. This depth has been selected as the maximum excavation depth because it is very unlikely that humans or biota would be exposed to soil contaminants located beneath 4 feet of clean fill. Also, shoring and confined space entry requirements are imposed at a depth of 4 feet. These requirements would add significant cost and increase execution times for each action. Other site-specific conditions may also limit excavation depths, such as the presence of critical utilities or saturated soils. Under some circumstances, it may be desirable to excavate beyond four feet.

The bulk of the soils will be excavated using mechanical equipment. Some hand excavation may also be required. Excavated soils will be placed in metal roll-off containers, each having a capacity of 5 to 20 cubic yards, depending on the specific project. Containers will be sealed when full. As many as 30 roll-off containers (20 cubic yards) may be required to contain 500 cubic yards of excavated soil depending upon the amount of bulking. Excavated materials will be transported and stored on site as discussed in Section 7.

Excavation will be performed in accordance with procedures described in **Plant Procedure Number 5-21000-OPS-GT.24**. This includes requirements for monitoring and control of dust (Standard Operating Procedure [SOP] FO.1), general equipment decontamination (SOP FO.3), and heavy equipment decontamination (SOP FO.4). In addition, SOP GT.24 requires approvals from appropriate plant operations, particularly Facilities Engineering (FE) which provides utility clearances. Appendix A provides detailed information on the procedures that will be used.

During the excavation process, field tests for radioactivity and/or hydrocarbon content (as appropriate) will be performed for every foot of depth of excavation in accordance with the procedures described in Appendix B.

- Gamma and low energy x-ray radiation will be evaluated using a Bicon Field Instrument for the Detection of Low-Energy Radiation (FIDLER).
- Alpha and beta/gamma surveys.
- Hydrocarbon content will be determined based on headspace analyses of bagged samples. Measurements will be made using either a photoionization (PID) detector or a flame ionization detector (FID) as appropriate.
- Additional real-time analyses for contaminants may be used as necessary to delineate the extent of contamination.

In addition, the soils exposed in the excavation will be visually described and logged.

When the field screening tests indicate that either sufficient soil has been excavated or the depth or volume limitations have been reached, confirmatory samples will be collected for laboratory analysis. Sampling and analysis methods to be used for confirmatory sampling are presented in Appendix B.

A Completion Report will be issued for each soil removal action.

3.2 SMALL VOLUME REMOVAL

Small volumes of contaminated materials may be excavated without issuance of separate Implementation Documents or other form of DOE, regulatory or public approval. Small volume removals are defined as soil quantities less than 5 cubic yards. However, an updated list of all planned and completed Small Volume Removals (SVR) will be provided monthly to the EPA, State and Public document centers.

The intent of the small volume exclusion is to expedite the removal of limited volumes of soils without delays imposed by the review process. It is presumed that these actions will:

- Be consistent with the selected final remedy,
- Protect human health and the environment,
- Be cost effective, and
- Significantly reduce the volume, toxicity, or mobility of contaminants.

All SVRs will comply to the extent practicable with ARARs.

Excavation, field verification methods, backfill and cover requirements as described in Section 3.1 will be followed. Excavated materials may be placed in drums or smaller roll-off containers. Excavated materials will be transported and stored on site as specified in Section 7.0.

A Completion Report will be issued for each small volume removal action. However, a combined report will be provided if only one OU is involved. Verification sampling will be completed in accordance with Appendix B.

3.3 CAPS AND COVERS

Two alternative cover designs will be used for the Soil Remediation IM/IRA: concrete or asphalt caps and vegetated soil covers. Covers are intended to achieve the following objectives:

- Stabilization of contaminated materials potentially subject to erosion or other mass movement,
- Elimination of potential for human exposure to contaminated soil,
- Elimination of potential for biota exposure to contaminated soil, and
- Minimization of percolation of water through contaminated soil.

3.3.1 Concrete or Asphalt Caps

Concrete or asphalt caps will be used at sites where a hardened surface is required, such as areas subject to regular vehicular traffic (i.e., loading docks, roadways and storage pads) and areas where erosion problems on site conditions make hardened surfaces a necessity. The design may use either concrete or asphalt depending upon the requirements of the site. Concrete caps will be a minimum of 4 inches thick. Asphalt caps will be a minimum of 3 inches thick. The actual thickness and design criteria will be based on the actual static and dynamic loadings expected.

3.3.2 Maintenance of Concrete and Asphalt Caps

Concrete and asphalt covers are generally maintenance free, however, cracks will be filled with a flexible sealer to prevent infiltration and further deterioration of the cover. Like vegetated soil covers, good drainage in the vicinity of the cover area should be promoted. Concrete and asphalt covers will be inspected on a quarterly basis.

3.3.3 Vegetated Soil Covers

This cover design takes full advantage of Colorado's arid climate and annual precipitation distribution to use evapotranspiration from plants to prevent infiltrated precipitation from mobilizing contaminants in soils under the covers. In its simplest form, the vegetated soil cover consists of two layers: a well-compacted soil layer of variable thickness overlain by a minimally-compacted soil layer supporting vegetative growth. In areas with large populations of burrowing animals, a biota barrier of cobbles, concrete rubble or fractured concrete will be placed below the well-compacted soil. The vegetated soil cover is shown in cross-section on Figure 3-1.

Vegetated soil covers create a physical barrier between the contaminated soil and the environment and severely limit percolation of precipitation through the cover and underlying potentially contaminated soil. These covers are much easier to design, construct and maintain than caps using vent systems, layers of clay, synthetic infiltration barriers and drainage materials, soils and vegetation. The cover also has an advantage over the more standard compacted clay cover in that problems associated with desiccation cracking are eliminated. Finally, the vegetated soil cover can be constructed fairly rapidly using on site soil, rather than imported clays. This reduces traffic, noise and dust impacts to the surrounding communities.

Figure 3-1

Features incorporated into the design of vegetated soil covers are as follows:

- The cover will be sufficiently thick to establish vegetation.
- The cover will incorporate both physical and visual barriers to intrusion of burrowing wildlife as necessary. Physical barriers will consist of fractured concrete, concrete rubble, or cobbles. Visual barriers will be created through the use of appropriate vegetation.
- Material used for the cover will consist of well graded soil without significant quantities of organic debris or grains of gravel size or larger.
- Sources of borrow material will be in the buffer zone or imported from off-site sources. Borrow operations will not impact natural drainage patterns or disturb wetlands.
- Final grades in both covered and borrow areas will be consistent with existing topography. To the extent possible, final grades will not exceed 7.5 percent (to minimize erosion potential) but will not be less than 2 percent (to promote overland drainage).
- Topsoil stripped from borrow areas will be selectively stockpiled and used on both the uppermost portions of the cover as well as for reclamation of the borrow areas.
- After final grading, the soils in both the cover and borrow areas will be amended as necessary with organic material to promote vegetative growth.
- Vegetation established on the cover and in the reclaimed borrow areas will be generally consistent with the requirements of the Rocky Flats Watershed Management Plan (Appendix A). Exceptions will be noted in the applicable Soil Remediation IM/IRA Implement Document.

3.3.4 Maintenance of Vegetated Soil Covers

The continued success of vegetated soil covers in preventing contact with contaminated soils and minimizing infiltration will require regular maintenance. Maintenance of these covers will include regular inspection of covers for erosion, subsidence and vegetation damage and completion of repairs as required.

Long-term irrigation of the vegetated soil cover should not be required. Seed mixes selected for the covers have been chosen for their ability to thrive on limited precipitation at Rocky Flats without requiring additional water from irrigation. Some covers may require supplemental water in order to establish seedlings depending upon the time of seeding, precipitation following seeding and site specific factors.

Proper care of vegetated soil covers requires that the thickness and slope of the original cover be maintained. Erosion damage should be rapidly repaired to minimize the long-term cost of repairs and the potential for exposure. Runoff collection areas and steeper slopes may be covered with geotextile mats or other erosion resistant materials to minimize erosion and promote plant growth.

Local depressions which may form due to settlement of the cover will be filled to grade and re-seeded. Drainage problems observed on or around the cover should be referred to a qualified engineer for correction.

Any areas requiring reseeding will use the same seed mix as originally specified in the Implementation Document unless an alternate mixture is recommended by an applied ecologist. Reseeded areas should be covered with mulch to prevent deflation (wind erosion) and retain soil moisture.

The covers will be inspected in accordance with the Watershed Management Plan by plant maintenance personnel for evidence of erosion, ponding, subsidence, animal burrows and vegetation damage. Minor repairs will be made in accordance with the plans and specifications contained (or referenced) in the Implementation Document. A sample inspection checklist (Table 3-1) is provided at the end of this section.

Each cover will be inspected on a biannual basis, prior to the growing season and again in September or October. Based on these inspections, procedures will be implemented as

TABLE 3-1
INSPECTION CHECKLIST FOR
VEGETATED SOIL COVERS

IHSS No.: _____

Inspected By: _____

Telephone No: _____

Inspection Date: _____

Date of Last Inspection: _____

Animal Burrows Present: Yes ☐ No ☐

Surface Depressions: Yes ☐ No ☐

Standing Water: Yes ☐ No ☐

Erosion Damage: Yes ☐ No ☐

Bare Ground Patches: Yes ☐ No ☐

Sickly/Damaged Vegetation: Yes ☐ No ☐

Comments: _____

Recommended Action: _____

Inspector's Signature

required to enhance vegetation vigor and promote nutrient cycling in the cover area such as fertilization, mowing or burning.

4.0 CRITERIA FOR REMEDY SELECTION

As discussed in the introduction to this document, potential candidate sites will be selected using the following criteria:

- Adequacy of available, validated environmental data;
- Current health and environmental risk;
- Potential for contaminant migration;
- Availability of soil storage, treatment, and disposal capacity;
- Compatibility with future OU remedial actions;
- Implementability of the action described in this Decision Document;
- Effectiveness of the action; and
- Achievement of ARARs.

Thus, the selection of IHSSs for inclusion in this IM/IRA process depends on the availability of validated site data, operational and remedial design constraints, and an approved list of ARARs or PRGs. The following sections discuss site data needs and their remedy selection implications.

4.1 BASIC DATA REQUIREMENTS

In order for an IHSS to be considered for possible early action under this IM/IRA process, there must be sufficient, validated environmental data to understand the nature and extent of contamination, the current health and environmental risks and the potential for contaminant migration. Data sufficiency is an extremely problematic issue; however, the following general guidelines will be used for removal and capping actions.

A minimum of nine samples of surficial soil and nine samples of subsurface material must be available. The samples must have been analyzed for the contaminant of concern. Additional details regarding sampling and analysis are presented in Appendix B.

4.2 EXCAVATION AND COVERS

Contaminated soil will be removed or covered only if sufficient, validated data are available to understand the nature and extent of contamination, the current health and environmental risks and the potential for contaminant migration. In addition, the action must meet the following criteria:

1. The action must be protective of human health and the environment;
2. The action must reduce current or potential risk with a goal of risk-based PRGs equal to or less than those for 10^{-4} cancer risk, 1.0 hazard index, or background levels;
3. The action must be consistent with, or must not interfere with the final action;
4. The action must be consistent with, or must not interfere with current plant activities; and
5. The action must be implementable using the plans, specifications and procedures described in this Decision Document with little or no modification.

There are also numerous site and contaminant specific factors which will influence the selection of the removal or capping remedies. Each of the remedies is discussed below.

Small Volume Removal

Small volume removal actions will only be undertaken for contaminated soil volumes of less than 5 cubic yards and that do not involve removal of soil from the saturated zone. In

addition, the contaminants must not pose an extreme threat to worker safety during the removal action.

Excavation

Contaminated soils will either be removed by excavation if the total volume of excavated material is anticipated to be less than 500 cubic yards. Removal will be given preference over capping if the depth of contamination is 4 feet or less [Occupational Safety and Health Act (OSHA)] shoring and confined entry procedures are not required), the area has a large population of burrowing animals, the contaminated soils appear to be an active source of ground-water contamination, or if the contaminants are not likely to degrade naturally into less hazardous compounds in the surficial or subsurface environment.

Capping

The capping remedy will be applied to contaminated sites involving more than 500 cubic yards of material. Capping is more attractive than removal if contamination is widespread, an excavation might endanger the stability of facility structures or utilities, the contaminants are biodegradable in the subsurface environment, depth to ground water is shallow (and an excavation would likely extend into ground water), or if the contaminants pose an extreme threat to worker safety during excavation.

4.3 REMEDY SELECTION PROCESS

The selection of an action for a specific IHSS will be presented in the Implementation Document. The procedure used will be based on the criteria and requirements included in this Decision Document as described below.

1. Determine if data requirements are met.

The basic data requirements are described in Section 3.1 and Appendix B of the Decision Document. These requirements must be satisfied before an IHSS can be considered for inclusion in the Soils Remediation IM/IRA. This may require additional field investigations if the available data are not adequate.

2. Determine if the candidate IHSS is an NFA.

Selection of NFAs is based primarily on risk assessment. The criteria and process for handling NFAs will be addressed in a separate document, and is not covered in this Decision Document.

3. Determine the need for early action.

The need for early action is based on the risk assessment as described in Section 6.

4. Determine if action is appropriate under this Soil Remediation IM/IRA.

In order for an action to be taken under this IM/IRA, the following requirements must be met:

- a) The action will reduce risk:
 - will be protective of public health, and
 - can be performed without significant risk to workers, plant site personnel, or the general public

- b) The action:
- has no need for special construction techniques,
 - can be performed in accordance with applicable standard plant procedures,
 - can be performed using the plans and specifications referred to in this Decision Document,
 - does not involve in-situ treatment, i.e., solidification, soil washing, etc., and
 - does not require more than 500 cubic yards of contaminated soil to be excavated.
- c) The action does not significantly interfere with:
- current plant activities, or
 - potential final OU remediation.
- d) The action will meet the ARARs and PRGs included in this Decision Document.

If an action is appropriate based on the above criteria, and the contaminated soil volume is less than 5 cubic yards, the action will be performed as described in this document without issuance of an Implementation Document.

5. Evaluate excavation versus covering.

The decision to excavate or cover an area of contamination will be based on criteria that relate to the COCs, existing site conditions, cost, effectiveness, and implementability. The following criteria will be considered:

a) Depth of Contamination

If greater than 4 feet depth, excavation becomes more complex due to OSHA requirements and costs increase. This favors the use of capping or a combination of excavation and capping. Shallow depth of contamination favors removal (excavation) because total volume may be smaller.

b) Groundwater

Is the contaminated area in contact with groundwater as evidenced by contamination in downgradient wells or contaminated soils that are below the water table? If the source is in contact with groundwater, excavation may be favored since this could eliminate the source.

Saturated soils will not normally be excavated as part of the Soil Remediation IM/IRA.

c) Slope

>5% - will tend to limit the use of simple vegetated soil covers due to erosion considerations. Slopes up to 20% may be covered using geotextiles, hardened surfaces, or terraces.

d) Stability

Slopes prone to failure would also be prone to cause failure of a cap or cover. In these situations, excavation may be favored.

Areas which are likely to experience differential settlement over short distances would not be suitable for caps using geosynthetic materials.

e) Drainage

Can good drainage of the site be developed either naturally or by regrading? If not, the use of caps or covers may not be feasible and excavation would be preferred.

f) Soil Type

Clays and silts are more stable under excavation than sands and gravels, which tend to flow into the hole being excavated. Therefore, clays and silts are better candidates for excavation while the presence of sand and gravel may favor capping.

g) Soil/Contaminant Reactions

Do soils readily adsorb contaminant particles? If so, then mobility is lower, potential for successful excavation is higher and potential for migration is lower. However, in situations where mobility is low, capping may be preferred due to cost considerations.

h) Contaminant Type

Degradable versus Persistent - degradable are better candidates for capping, particularly over larger areas.

Volatile versus Non-volatile - highly volatile contaminants are more difficult to excavate due to health and safety concerns. Therefore, capping would be preferred.

Potential for Worker Safety Problems - i.e., excavation may expose workers to volatiles or radioactive materials which require specialized PPE greater than Level C.

i) Utilities/Adjacent Structures

Excavation of contaminated soils adjacent to building foundations and buried critical utilities (i.e., optical fiber cable, gas mains, water mains, and alarm systems) may not be advisable, and capping may be preferred.

j) Anticipated Future Use

High use areas are more suited to excavation because this reduces the potential for exposure.

k) Habitat

Areas which are likely to attract burrowing animals should have armoring incorporated as part of cap design.

l) Costs

Costs will be evaluated in detail in the Implementation Document for each appropriate Soil Remediation IM/IRA candidate. The following factors will be considered:

Caps & Covers

- Design
- Construction
- Inspection
- Repair

Excavation

- Removal
- Backfill
- Storage
- Disposal

6. Determine the type of cap/cover

The actual type of cap/cover, if this option is selected, will be based on the above consideration plus maintenance requirements, compatibility with surrounding areas, and current use of the area. The use of a vegetated soil cover will generally be preferred; however, site-specific considerations may favor the use of concrete or asphalt. This evaluation will be provided in the Implementation Document.

A combination of cover and excavation may be selected for some sites. Since excavation requires backfilling with clean soil and either revegetating or paving, this alternative inherently includes the capping/cover alternatives.

5.0 POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) AND TO-BE-CONSIDERED GUIDANCE (TBCs)

This section contains potential ARARs and TBCs for the Rocky Flats Plant Soil Remediation IM/IRA. A summary of the ARARs and TBCs is included in Appendix C.

5.1 INTRODUCTION

This IM/IRA is designed to accomplish removal and capping of contaminated soils at the Rocky Flats Plant. Although the components of each interim action are unique, the soil removal/capping is not anticipated to result in the release of contaminants to surface water or ground water. Therefore, surface water and ground water standards will not be discussed in this section. The interim measures may result in air emissions, contaminated soils, and associated wastes intended for on site or off site disposal. This section presents current promulgated regulatory standards that may be applicable or relevant and appropriate to this proposal as well as guidance that will be considered along with ARARs.

Under Section 121(d)(1) of CERCLA, remedial actions that leave any hazardous substance, pollutant or contaminant on site, must attain a level of control that meets standards, requirements, limitations, or criteria that are "applicable or relevant and appropriate" under the circumstances of the release. A remedial action that does not meet ARARs may be selected only if statutory waiver is available and determined to be appropriate.

"Applicable" requirements are those cleanup standards, standards of control and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant or contaminant, remedial action, location, or other circumstance at a remedial action site. "Relevant and appropriate" requirements are cleanup standards, standards of control and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, while not "applicable", address problems or situations sufficiently similar to those encountered at the site so that their use is well-suited to the particular site.

The selected remedy will comply with all applicable or relevant and appropriate action-specific, chemical-specific and location-specific ARARs (Appendix C). Chemical-specific ARARs are those which set concentration limits for individual chemicals for air emission and soil standards. The action-specific ARARs apply to the use of specific technologies and practices such as excavation, surface impoundment or landfilling of hazardous waste. Finally, the location-specific ARARs relate to activities that are restricted from occurring in certain areas such as flood plains or wetlands.

TBCs are non-promulgated advisories or guidance issued by Federal or State government that are not legally binding and do not have the status of potential ARARs. TBCs may be considered along with ARARs for the IM/IRAs as guidance.

5.2 AMBIENT OR CHEMICAL-SPECIFIC ARARS

Chemical-specific ARARs are focused on the media of concern in which chemicals have been identified as the source of contamination. Therefore, for a specific IM/IRA, chemical-specific ARARs are those which set concentration limits for individual chemicals present in soil. There are no chemical-specific ARARs for soil; however, there are some guidance documents which can be used as TBCs. For example, the USEPA Office of Solid Waste and Emergency Response (OSWER) published guidance (Directive 9347-09FS) specific to delisting hazardous waste. There are about 30 chemicals in this guidance with a diminimus concentration for each which can be used as a TBC clean-up level. In addition, USEPA Region III and X have developed risk-based preliminary remediation goals (PRGs) for soil that may also be used as TBC clean-up levels.

5.3 LOCATION-SPECIFIC ARARS

Location-specific ARARs relate to activities that are restricted from occurring in certain areas such as flood plains or wetlands. The provisions of 40 CFR 6.302(a) and (b) regarding construction that would have an adverse impact on wetlands or within a flood plain, the Endangered Species Act (16 USC 1531 et seq.), the Migratory Bird Treaty Act (16 USC 703 et seq.), the Bald Eagle Protection Act (16 USC 688 et seq.) and dredged or fill material into waters of the US (40 CFR 230) are all considered relevant and appropriate to Soil Remediation IM/IRA. Based upon where the soil removals will occur, DOE believes that there

will be no adverse impact on wetlands from the soil removals. However, coordination will be maintained with the U.S. Fish and Wildlife Service to minimize such adverse wildlife impact from implementation of Soil Remediation IM/IRAs.

5.4 ACTION-SPECIFIC ARARS

The action-specific ARARs apply to operating specific technologies and practices such as excavation, surface impoundment or landfilling of hazardous waste. Specifically, regulations pertaining to air, landfill disposal restrictions, noise, wetlands, wildlife and radioactive wastes were reviewed. The Atomic Energy Act and the Occupational Safety and Health Act (OSHA) were reviewed as TBC material¹.

Air

In the context of this IM/IRA, there is a very remote chance of any release of volatiles, semivolatiles, metals or radionuclides other than fugitive emissions. Even if such a release did occur, it would only be intermittent and of very brief duration. This IM/IRA does not include construction of underground facilities which might result in a greater release of volatile organics or radionuclides. Therefore, air emissions during remedial actions will be minimal. Releases of volatile organics or radionuclides would cause ambient air quality standards to be

¹The RFP is not NRC-licensed and regulated and, therefore, Atomic Energy Act regulations are designated as TBC. In addition, worker protection under OSHA is not considered an ARAR under CERCLA.

potentially relevant or appropriate for construction activity. For example, the National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50) require that the annual geometric mean particulate matter emissions be less than 75 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and that the maximum 24-hour emissions be less than 26 $\mu\text{g}/\text{m}^3$. The 24-hour maximum cannot be exceeded more than once each year. However, this standard applies to Air Quality Control Regions, which are large areas encompassing a wide variety of industrial-type facilities. Similarly, Colorado Air Quality Control Regions, outlined in the Colorado Ambient Air Quality Standards (5 CCR 1001-14), apply to an entire region, not to individual sites, unless a specific site presents an adverse impact on the air quality standards for the Air Quality Control Region in which it is located. These numerical standards will not be applied individually to the specific emissions from the IM/IRA since the DOE does not anticipate that the IM/IRAs will be a major source or have a significant emissions rate as defined by either State or Federal regulations. However, this can not be definitively determined until each specific Soil Remediation IM/IRA is proposed. Should the IM/IRA for any site be shown to cause a significant adverse air quality impact, activity on that site (IHSS) may be deferred until the entire OU is ready for remediation.

The Colorado Emission Control Regulations for Particulates, Smokes, Carbon Monoxide and Sulfur Oxides (Regulation No. 1 of 5 CCR 1001-3) is applicable to the Soil Remediation IM/IRA. This regulation sets emission limitations, equipment requirements, and work practices intended to control the emission of particulates, smokes, and sulfur oxides from new and existing stationary sources (whether or not they have received a permit). Regulation No. 1

imposes requirements on the opacity of emissions from stationary sources (20 percent opacity). No new stationary sources or significant increases in emissions from existing stationary sources are expected under this IM/IRA. Therefore, this regulation will not apply. However, Regulation No. 1 Part III (d) (5 CCR 1001-3) contains specific provisions to control fugitive particulate emissions. All available practical methods which are technologically feasible and economically reasonable are required to minimize fugitive particulate emissions. Possible sources of emissions include unpaved and paved roadways, construction activities, mining activities, haul trucks, tailings piles and ponds, and demolition, blasting and sandblasting activities. Regulation No. 1 Part III (d) was found to be applicable and relevant and appropriate.

Regulation No. 6 (5 CCR 1001-8) implements and enforces standards of performance for new stationary sources. Stationary sources include fossil fuel fired steam generators, electric utility steam generating units, incinerators, and certain smelters. Regulation No. 6 addresses specific processes, production facilities and operations which are extremely dissimilar from the soil removal/capping proposed by this IM/IRA and, therefore, were found not to be applicable.

Regulation No. 7 (5 CCR 1001-9) sets emission limitations, equipment requirements and work practices to control the emission of volatile organic compounds (VOCs) from existing or new stationary sources. Control measures in this regulation are designed to reduce the ambient concentrations of ozone in ozone non-attainment areas. Regulation No. 7 addresses sources

which are dissimilar from the proposed removal actions of the IM/IRAs and, therefore, is not applicable. Regulation No. 8 (5 CCR 1001-10) sets emission control requirements for hazardous air pollutants, including beryllium, mercury and lead. Regulation No. 8 was found to be applicable and relevant and appropriate.

In summary, Regulations No. 1, 7 and 8 of the Colorado Air Quality Control Act (CRS 25-7-101 to 505) are relevant and appropriate because they specifically address particulate emissions from construction activities and the 20 percent opacity limitation. However, further review found these regulations as not applicable because they do not specifically address a remedial action or circumstance under CERCLA.

The Control of Hazardous Air Pollutants are outlined in the National Emissions Standards for Hazardous Air Pollutants (NESHAPS) under 40 CFR Part 61 and Colorado Regulation No. 8 (5 CCR 1001-10). The standards contained in the NESHAPS (40 CFR Part 61) were reviewed and determined to be applicable to the Soil Remediation IM/IRAs for benzene and radionuclides. For example, Subpart J applies to sources which include equipment which contains or contacts a fluid that is at least 10 percent benzene by weight. In addition, Subpart V is considered relevant and appropriate because it addresses fugitive emissions. For soils containing listed contaminants, requirements will be followed to minimize emissions.

For other chemicals², however, the NESHAPs applies to manufacturing processes and stationary sources of the pollutants not short-term construction activity.

Land Disposal Restrictions and Removal of Soil

For material determined to be hazardous waste, substantive State and Federal provisions are applicable to their management. These substantive provisions include but are not limited to: 40 CFR Part 262 (Standards Applicable to Generators of Hazardous Waste), 40 CFR Part 263 (Standards Applicable to Transporters of Hazardous Waste) and 40 CFR Part 264 (Standards for Owners and Operators of Hazardous Waste). These provisions are also covered in the Colorado Hazardous Waste Act (CRS 25-15-101 to 313). The Colorado Hazardous Waste Act contains guidelines and requirements for hazardous waste disposal sites.

The Land Ban regulations (40 CFR 268) are a direct result of the Hazardous and Solid Waste Amendments (HSWA) of 1984. For each hazardous waste, EPA establishes treatment standards that are protective of human health and the environment when the wastes are land disposed. Land disposal includes placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome or salt bed formation, underground mine or cave, or concrete vault or bunker. The Land Ban regulations were reviewed and determined

²Part A of Colorado Regulation No. 8 (5 CCR 1001-10) specifies emission control requirements for four pollutants listed by EPA in its NESHAPs program (i.e., beryllium, mercury, benzene, and vinyl chloride). In addition, Regulation No. 8 also addresses lead and hydrogen sulfide.

to be applicable and relevant and appropriate for any excavated soil that will be sent off site for disposal³.

The Corrective Action Management Units (CAMU) and Temporary Units Final Rule (58 FR 8656) was also reviewed. Although, at this time, the State of Colorado has not decided whether to adopt this rule in its annual RCRA authorization package, the CAMU rule may apply in the future. This rule allows establishment of a remediation unit under RCRA corrective action within which management of remediation waste does not constitute placement or disposal; therefore, remediated wastes would not have to comply with land disposal restrictions. An EPA regional administrator (or state hazardous waste program director) is authorized to designate a CAMU. In the event that a CAMU is established, criteria found in 40 CFR 264.552 would be considered applicable or relevant and appropriate under action-specific ARARs.

In addition, the Nuclear Regulatory Commission (NRC) rules specific to land disposal (10 CFR Part 61) of radioactive wastes are applicable to radioactive wastes placed in the ground. The Colorado Radiation Control Standard (6 CCR 1007-1) was reviewed and determined to be applicable as an ARAR. The standard presents an alpha activity limit for disposal of materials in soil (5 pCi/g).

³In addition, USEPA's proposed rule on Hazardous Soil (58 FR 48092) was reviewed. This rule proposed the regulatory framework for treatment of soil containing characteristic or listed waste in accordance with the land disposal requirements. This rule will be finalized in the Hazardous Waste Identification Rule due to be published in October 1994 and will have an impact on compliance with the land disposal restrictions.

Noise

The Colorado Noise Abatement Statute (CRS Section 25-12-103) is applicable and relevant and appropriate. It is more stringent than any applicable or relevant and appropriate Federal standard, requirement, criterion or limitation.

According to the standards, sound levels radiating from a property line at a distance of 25 feet or more in excess of the A-weighted sound levels in decibels [dB(A)] established for the following time periods and zones shall constitute prima facie evidence that such noise is a public nuisance:

Zone	7:00 a.m. to Next 7:00 p.m.	7:00 p.m. to Next 7:00 a.m.
Residential	55 dB(A)	50 dB(A)
Commercial	60 dB(A)	55 dB(A)
Light Industrial	70 dB(A)	65 dB(A)
Industrial	80 dB(A)	75 dB(A)

Between 7:00 a.m. and 7:00 p.m., noise levels may be increased by ten dB(A) for a period of not to exceed fifteen minutes in any one-hour period. In addition, periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five dB(A) less than those listed above. Construction projects are subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time limitation is imposed, for a reasonable period of time for completion of the project.

Wetlands and Wildlife

DOE does not believe that any wetlands could be adversely affected by the Soil Remediation IM/IRA. However, until a final design for each removal is selected, it cannot be definitively determined that no impact on wetlands will occur. If the final site selection and/or design results in an impact on wetlands, the DOE will review the regulatory provisions concerning wetlands impact and other appropriate guidance, and will proceed in a manner consistent with those provisions. There are no action-specific regulations for wetlands; however, location-specific regulations are mentioned in Section 5.3. The Colorado Wildlife Enforcement and Penalties (CRS 33-1-101 et seq.), which prohibits actions detrimental to wildlife, is relevant and appropriate. Coordination will be maintained throughout the project with the U.S. Fish and Wildlife Service concerning any potential impacts on wetlands or wildlife.

Radioactive Wastes

The Atomic Energy Act (CFR Title 10 Article 20) outlines provisions, requirements, and standards in the management of radioactive materials. Colorado State Radiation Control (CRS §25-11 Parts 1 and 2; and 6 CCR 1007-1) provides provisions and outlines state requirements in the management of radioactive materials and radioactive waste. 6 CCR 1007-1 Part 14 establishes the requirements for land disposal of low-level radioactive wastes, and Part 15 identifies the standards for low-level radioactive wastes. DOE provides guidance in the management of radioactive wastes from generation to disposal. All of these are considered ARARs.

5.5 DEPARTMENT OF ENERGY ORDERS

The DOE orders are not promulgated requirements and are not potential ARARs (EPA, 1989). The orders have been developed for internal DOE use and are not subjected to public review

and comment before issuance. The following orders incorporate guideline concentrations for chemicals and radionuclides:

DOE Order 5400.1 "General Environmental Protection Program"

DOE Order 5400.1 establishes DOE's environmental protection program requirements for compliance with applicable Federal, State and local environmental laws, regulations, and policies. This Order details the mandatory environmental protection standards that DOE will follow at all facilities. These standards are referenced in this document as appropriate for the proposed interim actions.

DOE Order 5400.5 "Radiation Protection of the Public and the Environment"

The DOE Directive 5400.5 (DOE, 1990) establishes broad standards and requirements designed to protect the public and environment against undue risk from radiation released from routine DOE activities and remedial actions. The following radiation exposure limits have been defined for members of the public:

- an effective dose equivalent of less than 100 millirem/year (all exposure pathways considered);
- a dose of less than 5 rem/year to any organ (all exposure pathways considered);
- doses of less than 25 millirem/year to the whole body and 75 millirem/year to any organ (only airborne emissions and exposure pathways considered);
- doses of less than 25 millirem/year to the whole body and 75 millirem/year to any organ (all exposure pathways considered, but only for releases from facilities that manage and store spent nuclear fuel, high-level waste or transuranic waste);
- an effective dose of less than 4 millirem/year (only the drinking water pathway considered); and

- DOE personnel and contractors shall strive to ensure that radiation doses to members of the public are as low as reasonably achievable below the appropriate limits.

The directive includes derived concentration guidelines (DCGs) for discharges of radioactively contaminated liquids to surface waters, aquifers, soil and sanitary sewerage systems.

Chapter VI "Residual Radioactive Material" sets the requirements and guidelines for the cleanup and management of residual radioactive materials in soils. DOE 5400.5 will be considered in the Soil Remediation IM/IRA⁴.

DOE 5820.2A "Radioactive Waste Management"

This order establishes policies, guidelines and requirements for managing DOE radioactively contaminated waste (e.g., transuranic and low level waste) starting with its generation and continuing through disposal. The requirements of this order are applicable to any radioactively contaminated waste, which, for the purpose of this document, would be generated from an IM/IRA involving radioactively contaminated soil.

5.6 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

Although NEPA requirements were waived by Congress and the 11th Circuit Court of Appeals for the CERCLA and RCRA programs, respectively, DOE has continued to apply NEPA to RCRA and CERCLA actions. The actions proposed to be taken under the generic Soil Remediation IM/IRA decision document, however, are categorically excluded from the preparation of either an Environmental Impact Statement (EIS) or an Environmental Assessment (EA). Under the authority of NEPA, DOE has identified classes of actions that individually or cumulatively will not cause adverse impacts to the environment and, therefore, can be

⁴Currently, in order to determine if a waste is radioactively contaminated for disposal purposes (either on site or off site), the material must first have a radiological evaluation performed in accordance with the No-Radioactivity-Added (NRA) program.

categorically excluded from NEPA. Regardless of these exclusions, the intent of NEPA (that is, to ensure the consideration of the widest possible range of beneficial uses of the environment with the goal of protecting the human environment) will absolutely be adhered to by all Soil Remediation IM/IRA actions.

The most relevant categorical exclusion that is applicable to Soil Remediation IM/IRA actions is as follows:

Removal actions under CERCLA (including those taken as final response actions and those taken before remedial action) and removal-type actions similar in scope under RCRA . . . including treatment, recovery, storage, or disposal of wastes at existing facilities. Actions include, but are not limited to: (a) capping or other containment of contaminated soils or sludges if the capping or containment would not affect future groundwater remediation and if needed to reduce migration of hazardous substances, pollutants, contaminants . . . into soil, groundwater, surface water or air; and (b) excavation or consolidation of contaminated soils or materials from drainage channels, retention basins, ponds, and spill areas . . . if such actions would reduce the spread of, or direct contact with, the contamination (10 CFR Part 1021, Subpart D, Appendix B).

Note, however, that an action can not be categorically excluded if it, among other things, meets any of the following conditions.

- It is "connected" to other actions with potentially significant impacts, or is related to other proposed actions with cumulatively significant impacts (10 CFR 1021.410).
- It requires siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (10 CFR 1021, Subpart D, Appendix B). The Accelerated Cleanup Program at Rocky Flats is predicted on the construction or possible expansion of waste storage facilities; however, the Soil Remediation IM/IRA actions alone are not the cause for these expansion plans. Regardless, incorporated into the planning process for constructing a waste storage facility is the explicit consideration of NEPA requirements for such a project.

- It adversely affects environmentally sensitive resources such as threatened or endangered species, or floodplains or wetlands (10 CFR 1021, Subpart D, Appendix B).

Regular communication will be maintained with the DOE-RFO NEPA Coordinator to, among other things, maintain the eligibility of Soil Remediation IM/IRA actions for the categorical exclusion.

6.0 RISK EVALUATION METHODOLOGY

6.1 RISK ASSESSMENT FOR IM/IRA

Current risk assessment methods were developed as part of CERCLA in order to demonstrate that the Superfund program appropriately considers protection of human health in the remedial process at CERCLA sites. This is accomplished by analyzing "baseline" risks, i.e. risks of adverse health effects that might exist if no remediation or institutional controls were applied at a site. Baseline risks are also used to determine the need for action at sites and the extent of such action. The risk assessment method for Superfund was developed to provide a consistent process for evaluating and documenting public health threats at sites.

6.2 ROLE OF RISK ASSESSMENT IN THE IM/IRA PROCESS

A semi-quantitative screening level approach to risk assessment has been taken for the Soil Remediation IM/IRA. This is appropriate because of EPA's proactive stance with regard to interim and early actions at CERCLA/RCRA sites. Several EPA guidance documents or directives support this approach, and relevant portions are discussed below.

In the guidance entitled *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* (EPA 1991b), "Early and interim actions" are addressed. The text states, "Early and interim actions RODs do not require a completed baseline risk assessment, although enough information must be available to demonstrate the potential for risk and the need to take action... These data should include a summary of COCs, concentrations, and relevant exposure information. A discussion should accompany these data explaining the need for immediate remedial action based on the presence of contamination that, if left unaddressed in the short-term, either contributes immediate risk or degradation of the environment/natural resources... The interim action ROD, however, should demonstrate

qualitatively (and quantitatively, if possible) that there is a risk or potential for risk and explain how the temporary measures selected will address a portion of this risk."

EPA has recently published guidance entitled *Guidance on Conducting Non-Time Critical Removal Actions under CERCLA* (EPA, 1993). The guidance states that "A risk evaluation that identifies only COCs in the affected media, contaminant concentrations, and the toxicity associated with the chemicals can be sufficient to justify taking an action." The guidance also states that when potential ARARs for COCs do not exist, risk-based chemical concentrations should be used, i.e., PRGs.

These texts would indicate that a qualitative, screening level approach to risk assessment for IM/IRA is reasonable. A screening level approach is not intended to replace the quantitative baseline risk assessment that is part of the RI process, but is meant to expedite and streamline the process for implementing IM/IRAs.

6.3 IDENTIFICATION OF POTENTIAL CONTAMINANTS OF CONCERN

For each IM/IRA considered, potential contaminants of concern (PCOCs) will be identified based on several sources of information. One of these is chemical-specific data on waste streams and inventories. In addition, if adequate site data are available, a comparison to background concentrations (primarily for metals and radionuclides) and/or to PRGs will also be performed. The comparison to background will be performed by comparing maximum contaminant levels to upper tolerance limits (UTL) on background concentrations. Compounds that are greater than background or that occur at levels that exceed PRGs will be retained as PCOCs. More discussion on the development and use of PRGs is presented in Section 6.4.

6.4 QUANTIFYING POTENTIAL RISKS FOR IM/IRA

The initial screening process for evaluating IHSSs for the Soil Remediation of IM/IRA is qualitative in approach (ICF Kaiser Engineers, 1994). However, following the initial screening, a method will be applied to quantitatively address potential risk. For the IM/IRAs, DOE proposes to address risk by developing PRGs for comparison to IM/IRA-specific contaminants. This approach is consistent with the agreement between the Agencies entitled "Data Aggregation for Human Health Exposure Assessment." These PRGs have been developed and are being reviewed by the EPA and CDH. Use of PRGs will significantly streamline the process since the comparison would be to maximum detected concentrations for an exposure area (IHSS). However, there are still unresolved issues such as specific assumptions for land use and target receptors. The PRGs are based on several different land uses, receptors, and exposure routes. The basic assumptions used in developing these PRGs are provided below and methods are consistent with both CERCLA and RCRA Guidance on developing such benchmark levels (EPA 1990 and 1991a). The basic approach used for developing PRGs relevant to the Soil Remediation IM/IRA includes the following:

- Target receptors include future on site commercial/industrial workers and ecological researchers. PRGs based on off site residential receptors are not considered, because those for on site receptors are more reasonable for this application and consideration of off site receptors would necessitate use of complex environmental modeling.
- Target cancer risk is 1×10^{-6} for carcinogens and a hazard quotient (HQ) of 1 for noncarcinogens.
- Exposure routes for soil contamination considered in development of PRGs include ingestion of soil, inhalation (VOCs or inorganics in soil particulates) depending on the particular receptor, and external (gamma) radiation exposure.

More complex pathway analysis is generally not warranted for PRGs and introduces an increasing level of uncertainty in the process.

For use as a screening tool for IM/IRAs, some modifications of the outlined approach have been made. These modifications include presenting PRGs based on the full risk range (as defined by CERCLA and RCRA) of 10^{-6} to 10^{-4} (EPA 1990 and 1991a). Consideration of risks higher than 10^{-6} may be appropriate, for example, in areas where future land use is anticipated to be restricted to nonresidential uses and access will be regulated by institutional controls. Similarly, for certain areas it would be inappropriate to consider PRGs based on residential land uses which, logically, will not occur. In this case, PRGs based on commercial/industrial receptors would be more applicable.

Programmatic risk-based PRGs have been developed by DOE which will be considered in establishing initial sitewide cleanup targets (DOE, July 1994). These PRGs are provided in Appendix D. It should be noted that these PRGs are currently under review by EPA and CDH and may undergo revision.

Considering the issues discussed above, the following applications of PRGs and target risks will be used:

- If representative IHSS data indicate that contaminant concentrations are below background concentration or below levels associated with 10^{-6} risk or HQ of 1, NFA is appropriate. NFA at a higher target risk level may also be appropriate, based on risk management decisions concerning land use, and the PCOCs. Proposed RCRA regulations (EPA, 1990) for corrective action, for example, state that a target risk of 10^{-5} should be used for PRGs based on carcinogens assigned a weight-of-evidence classification of "C" (possible human carcinogen).

- If representative IHSS data indicate that contaminant concentrations exceed the 10^{-4} risk level, PEA is probably appropriate. This decision, however, will be heavily influenced by analysis of data to determine the degree to which PEA could be implemented and effective. For example, contaminant levels for an IHSS may exceed the 10^{-4} target risk, but significant data gaps may exist or data may indicate that the areal extent of contamination is too extensive to be addressed by PEA.
- If neither NFA nor PEA is applicable, the decision on an appropriate action on the IHSS will be deferred until after the RCRA Facility Investigation/Remedial Investigation (RFI/RI) is performed. This would likely be the case for IHSSs with risk levels between 10^{-6} and 10^{-4} , for which potential risks will be more rigorously quantified later (i.e., in a baseline risk assessment).

6.5 RISK MANAGEMENT IN THE RISK ASSESSMENT PROCESS

Many of the above considerations require risk management decisions in order for the interim action to be undertaken. Some of these include:

- Assumptions concerning future land use and associated receptors;
- Target risk or risk range to be considered;
- Decisions concerning what, if any, interim action is necessary to protect human health and the environment, and what level of protection is required;
- Evaluation of economic, social, and political consequences of regulatory options.

In this document, alternatives for the Soil Remediation IM/IRA are either as NFA or PEA. PEA alternatives include limited excavation and/or capping. Both RCRA-CMS and CERCLA-RI/FS

guidance provide a list of evaluation factors to be considered for selecting a remedy. Of these factors, the following include some component for consideration of risks:

- Overall protection of human health and the environment must be demonstrated.
- Long-term reliability and effectiveness - The magnitude of residual risks remaining following a remedy must be considered in terms of volumes and concentrations,
- Reduction of toxicity, mobility, or volume - This factor includes consideration of amounts of contaminants treated or removed, and the toxicity and potential fate and transport mechanisms that may impact residuals.
- Short-term effectiveness of a potential remedy - Short-term risks to the community, workers, and environment during implementation of a remedy are considered.

For each IM/IRA, all proposed alternatives will be evaluated for the above factors in terms of potential risks. Overall protection of human health and the environment will be assessed for all proposed alternatives in terms of existing risks and residual risks following any remediation.

In general terms, the following can be inferred for the NFA alternative:

- The alternative is expected to be reliable and effective for the long-term because risks are estimated to be low.
- There is no reduction in toxicity, mobility or volume because no further treatment is applied.

- There are no short-term risks because no further treatment is applied.

Similarly, the following can be inferred regarding the PEA alternatives:

- Either remedy would be effective and provide protection pending the final remediation action. Residual risks would be reduced either through removal of contaminants or elimination of an exposure pathway through capping.
- Capping would result in reduction of mobility, but would not result in reduction of toxicity or volume. Excavation and the proposed cover for such actions would result in reduction in toxicity, mobility and volume.
- Short-term effectiveness will be achieved by using appropriate control measures such as dust control and temporary covers for excavated areas.

7.0 WASTE MANAGEMENT

This section discusses in general terms the Rocky Flats Plant Field Operation Procedures applicable to managing wastes generated during the Soil Remediation IM/IRA. Additional procedures may require development depending on type of containerization and off site disposal location. These procedures will be included in the Implementation Plan. A more specific discussion of waste management procedures is presented in Appendix E. The site manager will be responsible for adhering to these procedures and, in general, the proper handling of all materials generated during soil remediation IM/IRAs. This section discusses the handling of the generated waste, waste storage/disposal options, and managing field decontamination wastes.

7.1 HANDLING OF WASTE FROM SOIL IM/IRAS

The contaminated soil (containing low-level radioactive, low-level mixed, or hazardous materials) removed from the IHSS during the IM/IRA will be containerized at the site in drums (either 55-gallon or 30-gallon), in half-boxes, or large capacity roll-off containers depending on the expected volume of contaminated soil. The intent will be to minimize the number of containers. No soil will be excavated without the approval of Rocky Flats Waste Management.

Before soils are excavated, the site team will secure the necessary drums or containers to store the wastes. The site team will receive the drums or containers from EG&G, and EG&G will assign each a unique identifying number. The site team will use this number to track each drum or container on a Field Log Form until it is returned to EG&G.

Once a drum or container is filled, it will be sealed with a bolt and a temporary sample custody seal will be placed on it. The site team will then mark each drum or container with proper locational information, sample number(s) of samples taken from the container, and

date it was filled. This information will also be recorded on the Field Log Form. The containers will then be transported to a waste transfer/storage area.

At the storage/transfer area, the site team will present copies of the completed Field Log Forms and other required documentation (see Appendix E) to the receiving EG&G Waste Operations or Waste Management personnel. The receiving EG&G personnel will inspect the drums or containers and if they pass inspection, the EG&G personnel will sign the forms and relieve the site team of the responsibility for the drums.

7.2 STORAGE/DISPOSAL OPTIONS FOR WASTE FROM SOILS IM/IRAS

The options for disposing of the contaminated soils removed during IM/IRAs will depend on whether the waste is characterized as hazardous, low-level radioactive, or low-level mixed waste. Contaminated soils characterized as hazardous waste will be transported off site for disposal in accordance with Waste Management procedures.

7.3 MANAGING FIELD DECONTAMINATION WASTES

The site team will reduce the contamination of equipment and container surfaces in the field in an effort to reduce overall contamination before these items are moved from the work site. To accomplish this decontamination, the site team will follow all applicable procedures, including documentation requirements, as specified in Field Operation Procedure FO.3 - General Equipment Decontamination and Field Operation Procedure FO.4 - Heavy Equipment Decontamination. These and other procedures identified in this section are discussed in more detail in Appendix E.

The site team will follow the procedures specified in Field Operation Procedure FO.7 - Handling of Decontamination Water and Wash Water to properly dispose of any water generated during field decontamination activities. In general, the site team will contain

decontamination water in drums. The site team will properly dispose of decontamination water per established plant procedures.

The site team will dispose of potentially contaminated personal protective equipment (PPE) in accordance with Field Operation Procedure FO.6 - Handling of PPE. In general, PPE will be double-bagged in 3-mil plastic bags and these bags will be transported to the specified location for disposal.

8.0 DOCUMENTATION

8.1 IMPLEMENTATION DOCUMENTS

An IM/IRA Implementation Document for each candidate site other than small volume removals will be issued by DOE when sufficient data have been assembled to meet the criteria specified in Section 4 and Appendix B. The purpose of the Implementation Document is to:

- Provide a brief site history and description,
- List the data for the site related to the proposed action,
- Explain the rationale for selection of the interim action in accordance with Sections 4, and
- Provide engineering plans and specifications in sufficient detail to implement the action.

A recommended outline for Soils Remediation IM/IRA Implementation Documents is shown in Table 8-1.

A thirty day (calendar) review period will be provided for regulatory review (EPA and State) of the Implementation Document once it is issued. Unless a request to postpone the action is received prior to expiration of the review period, DOE may commence work.

The first section of the Implementation Document will provide a brief history of the IHSS and describe previous remediation and enforcement activities. More detailed information related to site history will be referenced.

The Implementation Document will include a physical site description. The purpose of this portion of the document is to describe site physical conditions using text and figures. Only

TABLE 8-1

**SOIL REMEDIATION IM/IRA
IMPLEMENTATION DOCUMENT OUTLINE**

- 1.0 SITE DESCRIPTION**
 - 1.1 Site History and Previous Remediation/Enforcement Activities**
 - 1.2 Site Description**
 - 1.2.1 Topography**
 - 1.2.2 Hydrology**
 - 1.2.3 Utilities**
 - 1.3 Current and Projected Future Use**
- 2.0 SUMMARY OF CONTAMINANTS**
 - 2.1 Contaminants of Concern**
 - 2.2 Extent of Contaminants**
- 3.0 COMPARISON OF ALTERNATIVES TO CRITERIA**
- 4.0 SELECTED ACTION**
- 5.0 CONSTRUCTION WORK PLAN**
- 6.0 SCHEDULE**
- 7.0 ESTIMATED COST**
- APPENDIX A - DATA LISTING**

66

physical features which may be relevant to selection and implementation of the remedy will be included. Of particular interest are surface topography, depth to groundwater (or potentiometric surface) across the site, location of utilities (underground and overhead), location of roads and paved areas, location of adjacent buildings, sensitive wildlife areas, soil classifications, and site specific geology. Related information not directly required for selection and implementation will be incorporated by reference.

Current and projected future land use will be briefly discussed in the Implementation Document if it impacts remedial selection action. Although the future use of the site may not be defined at the time the Implementation Document is issued, those site conditions that may influence future land use as well as remedial action will be identified. Examples of such conditions include: location within a flood plain, slope, proximity to the Industrial Area or to valuable habitat.

The Implementation Document will contain a brief summary of the contaminant data for the site which is relevant to the action. COCs will be identified as described in Section 5 of the Decision Document. Data may be summarized in tabular form and in drawings showing sampling locations and approximate distributions (horizontal and vertical) of COCs.

An appendix will be provided which lists all soils data used to determine the type and extent of the action. If existing soils data are not used in the remedy selection or implementation process, an explanation will be provided detailing the reasons for rejection. Ground and surface water data will be included only as appropriate.

The rationale for selecting the site specific remedy will be included. A brief discussion of alternative capping or excavation combinations will be presented as appropriate.

Engineering documentation (drawings and specifications) required to execute the action will be included in the Implementation Document. Final drawings will include existing topography,

proposed final topography, building locations, utility locations, survey benchmark locations, location of proposed sampling points, estimated limits of excavation, waste haul routes and site access roads. Additional design details will be provided as required (i.e., for placement of geotextile mats, drainage facilities, cover layers, concrete reinforcement, etc.).

Specifications and procedures contained in this Decision Document may be incorporated in the Implementation Document by reference. When specifications contained in this Decision Document are modified, a new specification will be prepared and included in the Implementation Document. Site specific seed mixtures will be specified.

The Implementation Document will contain a construction work plan which will briefly describe the proposed construction methods and sequence of execution. A project schedule will also be provided along with a construction cost estimate. A sampling plan for confirmation sampling will also be included.

Although a site-specific health and safety plan will be prepared for the work, this plan will be considered an internal document and will not be included in the Implementation Document.

8.2 COMPLETION DOCUMENTS

The Completion Report will be part of the permanent IM/IRA record and will be used by OU managers as input to the RI/FS process as appropriate. A Completion Report will be prepared for each action including small volume removals after all IM/IRA work is completed and analytical data are validated. The report will consist of a brief description of the work which was completed, analytical results and exceptions to the original plan. Correspondence with regulatory agencies related to implementation of the action will be included in the completion report.

The completion report will also contain the "as-constructed" drawings for the remedial action. These drawings will show the actual limits and depths of excavation and the extent of the caps and covers based upon both field notes and survey data. The location of verification samples will be indicated on a site plan and survey locations will be provided in an appendix.

8.3 MONTHLY REPORTING

Monthly progress reports will be prepared to keep EPA and the State apprised of the progress of the activities required for implementation of the Soil Remediation IM/IRA. The progress reports will provide information regarding status of work performed during the previous month, consisting of action specific details including, but not limited to: samples taken, status of construction work for all remedial/corrective actions taken, problems encountered and their resolution, status of analytical results, and results of environmental monitoring related to remedial/corrective action.

9.0 EPA, STATE & PUBLIC COMMENTS

This section to be prepared later.

10.0 RESPONSIVENESS SUMMARY

This section to be prepared later.

11.0 REFERENCES

- DOE, 1991. InterAgency Agreement.
- EG&G Rocky Flats, Inc., 1994, An Analysis of the Potential for Redirection of the Rocky Flats Environmental Program. February 1994.
- EPA Guidance Document for Assessment of RCRA Environmental Data Quality - Office of Solid Waste
- EPA, 1979, Radiochemical Analytical Procedures for Analysis of Environmental Samples, Report No. EMSL-LY-0539-1, U.S. Environmental Protection Agency, Las Vegas, Nevada.
- EPA, 1986, Test Methods for Evaluating Solid Waste, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Third Edition (with periodic updates), November.
- EPA, 1988, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, EPA/540/G-89/004, OSWER Directive 9355.3-01, October.
- EPA, 1989a, Methods for Evaluating the Attainment of Cleanup Standards, Volume 1, Soils and Solid Media, U.S. Environmental Protection Agency, Office of Policy, Planning and Evaluation, EPA 230/02-89-042, PB89-234959.
- EPA, 1989b, Guidance on Preparing Superfund Decision Documents: The Proposed Plan, The Record of Decision, Explanation of Significant Differences, The Record of Decision Amendment, Interim Final, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, EPA/540/G-89/007.
- EPA 1990. Corrective Action for Solid Waste Management Units (SWMUs) at Hazardous Waste Management Facilities. Proposed Rule. Federal Register. Vol. 55, No. 145. Friday, July 27, 1990.
- EPA 1991a. Risk Assessment Guidance for Superfund: Vol. I - Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals). Publication 9285.7-01B. Interim.
- EPA 1991b. *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-30.

EPA 1993. Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA. EPA Office of Emergency and Remedial Response. EPA/540-R-93-057. PB93-963402, August.

ICF Kaiser Engineers, Inc., 1994, Process for Determining the Remediation Category of IHSSs, Prepared for EG&G Rocky Flats, Inc.

Morrison Knudsen Corporation, 1993, A Revised Approach to Implementation of IM/IRAs at Rocky Flats, prepared for ICF Kaiser Engineers, Inc.

U.S. Department of Agriculture, Soil Conservation Service, 1972. SCS National Engineering Handbook, Section 4, Hydrology.

U. S. Department of Energy, U.S. Environmental Protection Agency and State of Colorado, 1991, Rocky Flats Interagency Agreement, Ref. KF100.135.

U. S. Department of Energy, 1994 Soil Remediation IM/IRA Proposal Letter to Martin Hestmark, U.S. Environmental Protection Agency, and Joseph Schieffelin, Colorado Department of Health.

U.S. Department of Energy, July 1994, Programmatic Risk-Based Preliminary Remediation Goals.

U.S. Environmental Protection Agency, 1989. Technical Guidance Document: Final Covers on Hazardous Waste Landfills and Surface Impoundments. EPA/530-SW-89-047.

APPENDIX A:
SPECIFICATIONS
AND PROCEDURES

A number of IHSSs will be selected for the early actions of excavation and/or capping under this IM/IRA. In general both of these actions involve multiple steps or sub-work tasks which will include:

- Soil Disturbance Permits
- Integrated Work Control Packages (IWCP)
- Site Preparation
- Excavation
- Vegetated Soil Covers
- Asphalt Covers
- Concrete Covers
- Maintenance

Purpose: The purpose of this appendix is to provide procedures and specifications for these sub-work steps which form the overall action for the selected IHSSs. These will be presented in readable and understandable format and will reference other more detailed Rocky Flats Plant (RFP) procedures as appropriate.

A.1 SOIL DISTURBANCE APPROVAL

Before any work is performed at Rocky Flats by subcontractor or EG&G groups involving disturbance of soil, a Soil Disturbance Approval from the Construction Management (CM) department is required. The RFP procedure for soil disturbance approval is 4-4500-COCM-4.02, titled Excavation/Soil Disturbance. The steps of the process needed to obtain this approval are outlined below:

1. **The Requestor** [generally the Construction Coordinator (CC) or Construction Engineer (CE)] fills out the Soil Disturbance Evaluation Form. This form can be obtained from the CM department's Excavation Specialist.
2. **The Requestor** provides the Excavation Specialist with accurate plans/drawings showing the locations of proposed excavation/soil disturbance and provides a detailed scope of the proposed activity.
3. **The Excavation Specialist** reviews the Soil Disturbance Evaluation Form (SDEF), plans, drawings, and detailed scope for accuracy and completeness. If this package is acceptable, the excavation specialist completes the Site Survey Determination Form (SSDF), adds it to the package, and submits it to Environmental Management.
4. **Environmental Restoration Management (ERM)** reviews historical data of the area and provides written information as required by their assessment on the SSDF. The package is then passed on to Industrial Hygiene.
5. **Industrial Hygiene (IH)** reviews the package to determine if a sampling plan is needed to satisfy Health and Safety (H&S) non-radiological requirements, assures that PPE requirements have been defined on the SSDF, assures that required monitoring during excavation/soil disturbance has been addressed, defines

confined space requirements, outlines the potential hazards, recommends any engineering or administrative controls needed, and completes the IH portion of the SSDF. The package is then delivered to Radiological Engineering.

6. **Radiological Engineering (RE)** reviews the package to determine if a sampling plan is needed to satisfy H&S requirements for Radiological Protection and completes the RE portion of the SSDF. The package is then delivered back to the Excavation Specialist.
7. **The Excavation Specialist** adds the Soil Disturbance Approval Form (SDAF) as a cover to the package and delivers the package to Facilities Engineering.
8. **Facilities Engineering (FE)** reviews the package to determine the exact area for excavation/soil disturbance and assigns a boundary to the excavation by drawing a red line on the plan/blueprint. FE assigns a log number to the package, enters the log number on the SDAF, determines the utility drawings affected by the proposed activity, and enters this information on the SDAF. The package is then delivered back to the Excavation Specialist.
9. **The Excavation Specialist** reviews the information supplied to the package by ER, IH, RE, and FE to ensure completeness, and makes copies of the package. A copy of the package is then delivered to the requestor.
10. **The Requestor** incorporates the package into the IWCP work package and notifies the Excavation Specialist when the work package is complete and the work scheduled to start.
11. **The Excavation Specialist** surveys the area of excavation/soil disturbance to determine utility interference; marks locations of known utilities; conducts a field indoctrination of all involved personnel informing them of existing or potential hazards; requires all workers, operators, and their supervisors to sign the SDAF; completes the information on the SDAF for cautions/special instructions and disturbance limits; and signs the form. At this point the subcontractor or maintenance is authorized to begin the excavation/soil disturbance.
12. If personnel are required to enter an excavation, the **Excavation Specialist** must classify the soil per OSHA 29 CFR 1926, Appendix A, instruct all personnel involved in an entry of the OSHA requirements, ensure that an initial safety inspection is performed, and ensure that daily inspection are performed.
13. **The Construction Coordinator** provides the first (field) inspection to insure that work is being done according to OSHA standards and Rocky Flat plant policies and procedures. The construction coordinator also ensures that all personnel involved use the required PPE; that proper barricades are provided per OSHA 29 CFR 1926.651; interfaces with subcontract on a daily basis to resolve problems, deficiencies, or concerns; contacts the Excavation Specialist, IH, or Occupational Safety if adverse conditions exist or appear; and notifies other plant organizations as needed by the IWCP work permit.

A.2 IWCP WORK PACKAGES

The IWCP is the RFP approved method for requesting modifications to facilities, systems, equipment, and plant grounds. This process must be followed by all EG&G employees and subcontractors involved in on site work at RFP. The approved RFP procedures governing this process are 1-E32-IWCP-1, "Work Control Form Processing"; 1-74000-IWCP-2, "Maintenance Action Center"; 1-E33-IWCP-3, "Maintenance Work Package Planning Process"; 1-74000-IWCP-4, "Logistics And Material Control"; 1-E34-IWCP-5, "Conduct Of Maintenance Work"; 1-74000-IWCP-6, "Maintenance Emergency Priority Work"; and 1-74000-IWCP-7, "Preventive Maintenance Process". The important steps of this process needed for anticipated interim remedial actions are outlined below:

Work Control Form Processing

1. The **IM/IRA Manager** records basic information on the location and type of work to be performed on the Work Control Form (WCF) and transfers the WCF to the Shift Manager for operations area affected.
2. The **Shift Manager** reviews the WCF to determine if emergency priority work is required (IM/IRA do not require emergency priority response) and then transfers the form to the Operations Manager.
3. The **Operations Manager (OM)** reviews the WCF; completes the Operations Manager Processing section assigning a priority level and a safety priority, recording a concise Corrective Action Title and recommendations; completes the Support Requirements section by determining support requirements and the type of Work Package (A, B, C); determines the responsible organization; and assigns a resolution date. The OM then forwards the original WCF to the responsible organization and sends a copy to the originator.
4. The **Responsible Organization Manager** reviews the WCF for completeness and accuracy, resolves any disagreements that exist on the support requirements or work classification, and routes the WCF to the Maintenance Manager.
5. The **Maintenance Manager** reviews the WCF for a Davis-Bacon Act determination and routes the form back to the Operations Manager.
6. The **OM** routes the completed work package to the Responsible Organization or Sub-contractor and authorizes work to commence.

Work Package Planning and Approval

1. The **OM** reviews the WCF and makes the determination that either an existing Standard Work Package (SWP) can be used or that a new Work Package (WP) must be developed.
2. The **Planner** evaluates the work to be performed, determines the organizations required to review and approve the WP or SWP, and determines the activities to

be performed. The Planner then develops a Type A, B, or C WP or SWP in accordance with the Maintenance Work Package Planning Guide.

Since IM/IRA actions are expected to require process radiological controls, this work will generally use Type B work packages. A Type C work package is used primarily for routine non-radiological and preventive maintenance work. A description of the Type A, B, and C development requirements is provided below.

Type A and B WP/SWP Development

1. The Planner completes either the WP or SWP Cover Sheet, develops a Table of Contents and obtains a computer-generated WCF, a Baseline Document Change Form, and a Work Package Change Log (WPCL) to place in the WP/SWP.
2. The Planner prepares a list of required drawing and references to include (See Section 6.2.5 and Appendix 11 of procedure 1-E33-IWCP-3), develops a Bill of Material (BOM) or Construction Bill of Material (CBOM), and a List of Special Tool Requirements to include in the WP/SWP.
3. The Planner develops initial conditions/prerequisites that apply to the WP/SWP and specifies the conditions in which equipment, system, or jobsite is to be placed before work may commence.
4. The Planner develops the six required subsections of the WP/SWP which include: (1) Purpose of the WP, (2) Scope of the WP, (3) Precautions and Limitations of the work, (4) Preliminary Actions, (5) Site Preparations, (6) Approvals and Notifications.
5. The Planner develops specific task instructions with help from appropriate plant organizations to include: (1) Safety precautions, (2) Radiological controls, (3) Inspections, (4) Hold points, (5) Special test required by CBOM.
6. The Planner develops Post-Maintenance Testing (PMT) instructions (five required sections) that apply to the WP/SWP with help from Engineering, Operations Manager, and Maintenance.
7. The Planner develops a list of required craft and support personnel identifying craft categories, number of personnel in each category, and estimated total number of work hours for each craft to include in the WP/SWP. He also develops the appendixes called out in Section 6.2.12 of procedure 1-E33-IWCP-3 and the optional appendixes called out in Section 6.2.13 as appropriate.
8. The Planner develops the needed appendixes.
9. The Planner has the WP reviewed and marked appropriately for classification, obtains concurrences as required in the applicable appendixes of procedure 1-E33-IWCP-3, and submits the WP to the Maintenance Action Center (MAC).

10. The **MAC Coordinator** obtains comments and concerns or signatures for the WP from representatives of the following organizations in accordance with Appendix 1 of procedure 1-E33-IWCP-3: (1) Responsible Organization, (2) H&S Area Management, (3) Radiation Protection, (4) Engineering, and (5) QA. the MAC coordinator submits the WP to the OM for final approval.

Type C WP Development

1. The **Planner, Responsible Manager, or OM Manager** completes the WP Cover Sheet.
2. The **Responsible Manager or OM** obtains a computer-generated WCF, as the work description and authorization document for all Type C WPs.
3. The **Planner** develops a more detailed task instruction, PMT, and BOM as required and includes in separate sections of the WP.
4. The **Responsible Manager or OM** use the Responsible Organization section of the WCF to document the task instructions with simple, concise statements. The **Planner** develops additional task instructions and includes as a separate section in accordance with directions from Responsible Organization, Craft manager, OM, and Job Supervisor.
5. The **Responsible Manager or OM** uses the Responsible Organization section of the WCF to document PMT task with simple, concise work instructions. The **Planner** develops additional PMT instructions and includes as a separate section in accordance with directions from the Responsible Organizations, Craft manager, OM, and the Job Supervisor.
6. The **Planner** has the WP reviewed and marked appropriately for classification, obtains concurrences as required in the applicable appendixes of procedure 1-E33-IWCP-3, and submit the WP to the Maintenance Action Center (MAC).
7. The **MAC Coordinator** obtains comments and concerns or signatures for the WP from representatives of the following organizations in accordance with Appendix 1 of procedure 1-E33-IWCP-3: (1) Responsible Organization, (2) H&S Area Management, (3) Radiation Protection, (4) Engineering, and (5) QA. The MAC Coordinator then submits the WP to the OM for final approval.

Maintenance Action Center

Approved IWCP Work Packages are submitted to the MAC for coordinating plant schedules and resources needed to execute the required work. The MAC is staffed by personnel authorized to represent and make commitments for the following organizations: (1) Operations, (2) Systems Engineering, (3) Quality Assurance, (4) Health and Safety, (5) Maintenance, (6) Logistics, (7) Planning, and (8) Radiation Protection. In addition, this staff is augmented as required by: (1) Design Engineering, (2) Radiation Engineering, (3) Scheduling, and (4) other organizations needed to support planned activities. These personnel having signature authority review work

packages in accordance with the priorities assigned by the OM. The MAC maintains a schedule and tracks priority work actions designated by the OM.

The OM selects and prioritizes a reasonable number of jobs to manage (e.g. the "top fifty") based upon the resources available to support the MAC and the urgency of the open work. Support organizations estimate the time required to perform their individual task for each job. This information is used by the MAC coordinator to develop a resource-loaded schedule for performing each WP. The MAC coordinator authorizes the work to commence and tracks the status of the work in progress.

A.3 SITE PREPARATION

Prior to starting any soil disturbance such as site preparation or grading in preparation for excavation or capping, an Integrated Work Control Process (IWCP) package must be prepared and approved. The IWCP package is prepared as described in Section B.2 and will include an approved soil disturbance plan which contains the information necessary to guide the safe execution of all soil disturbance activities at the Rocky Flats Plant. In addition, all earthwork shall be performed in accordance with the specifications of the Rocky Flats Engineering Department's Master Specifications, Section 02200--Earthwork. This section provides the following general directions and specifications pertaining to site preparation.

1. A survey and layout of the work shall be performed. If diversion or removal of any ground water is anticipated, approval must be obtained from Operations Manager.
2. Provisions shall be made to protect streets, roads, grading, structures, utilities and other improvements not specifically designated to be cleared, removed, stripped, or altered as a part of the work. Existing utilities within the work area must be located and marked by the CM Excavation Specialist.
3. All equipment and tools to be used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working conditions at all times.
4. Submittals needed to support the work shall be available, such as initial test results for materials proposed for use.
5. **Clearing** shall consist of satisfactory disposal of vegetation designated for removal, including snags, brush, and rubbish occurring in the areas to be cleared and grubbed for the work. Roots, brush, and other vegetation in areas to be cleared for the work shall be cut off flush with or below the original ground surface.
6. **Grubbing** shall consist of the removal and disposal of brush and matted roots from the areas required to be cleared and grubbed for the work. The removal of this material shall be covered by the IWCP work package.

7. All clearing, grubbing, and site grading shall be performed in such a manner that the area of the site and the area immediately surrounding the site will be continually and effectively drained by gravity or by temporary pumps.

A.4 EXCAVATION

The amount of material to be excavated and its location, depth, and areal extent will be indicated in the IWCP work package. The IWCP work package excavation requirements will be strongly influenced by the type of contaminants, their concentration as a function of depth and areal extent, their mobility, and other considerations.

All earthwork shall be performed in accordance with the specifications of the Rocky Flats Engineering Department's Master Specifications, Section 02200--Earthwork, and Procedure 1-B37-HSP-12.08, "Excavations and Trenching", which are included in this appendix.

A.5 VEGETATED SOIL COVERS

The basic cover design contemplated for this Soil Remediation IM/IRA is shown in Figure 1 and described in Section 2.4. Construction of these covers shall be in conformance with Section 02200 - Earthwork and Specification 1000 - Soil Preparation, Seeding, and Mulching.

A.6 ASPHALT COVERS

The asphalt cover anticipated for the soil remediation IM/IRA consist of a three inch bituminous mixture constructed on a prepared foundation in accordance with the specifications of the Rocky Flats Engineering Department's Master Specifications, Section 02600--Asphalt Concrete Paving. This specification is included in this appendix.

A.7 CONCRETE COVERS

Covers anticipated for the soil remediation IM/IRA will consist of a four inch concrete layer prepared in accordance with the specifications of the Rocky Flats Engineering Department's Master Specifications, Section 03350--Concrete, which is included in this appendix.

SECTION 02200 - EARTHWORK

PART I: GENERAL

- 1.1 APPLICABLE PUBLICATIONS. The following publications of the latest issues listed below form a part of this Specification.

A. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS

1. ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D1556, Density of Soil In-Place by the Sand Cone Method.
3. ASTM D1557, Moisture-Density Relations of Soils and Soil-Aggregate Mixture Using 10-Lb. (4.54 kg) Rammer and 18-In. (457 mm) Drop.
4. ASTM D2922, Density of Soil-Aggregate In-Place by Nuclear Method (Shallow Depth).
5. ASTM D3017, Determination of Moisture Content in Soils by Nuclear Method.
6. ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
7. ASTM E11, Specification for Wire-Cloth Sieves for Testing Purposes.

- 1.2 SECTION INCLUDES: Clearing and grubbing, excavation, trenching, bedding, backfilling, compaction, and grading associated with the sitework and other work required for this Project.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300, Submittals
- B. Section 01700, Construction Safety Requirements
- C. Section 02240, Aggregate Base Course
- D. Section 02500, Storm Drainage Systems
- E. Section 02551, Sanitary Sewer Systems
- F. Section 02553, Water Lines
- G. Section 02554, French Drains
- H. Section 02900, Topsoil and Revegetation

1.4 SURVEY AND LAYOUT OF WORK

- A. The survey and layout of the work shall be performed as indicated in the Clause entitled "LAYOUT OF WORK" in the Special Provisions.
- B. The Subcontractor shall provide to the Contractor copies of *all* field notes from surveying and layout *at the end of each day that surveying or layout is performed.*

1.5 APPROVAL: Prior to starting any soil disturbance, excavations, backfilling, or other operations, an approved Integrated Work Control Program (IWCP) package shall be obtained from the Contractor. The IWCP package will include an approved soil disturbance plan which contains the information necessary to guide the safe execution of excavation/soil disturbances at the Rocky Flats Plant.

- A. Do not divert, remove, or pump, any ground-water, or water from any trench, manhole, or ditch without approval from the Contractor.

1.6 PROTECTION AND SAFETY

A. General

- 1. See "Section 01700 -- Construction Safety Requirements" for more specific and additional protection and safety requirements for the work, particularly trenching and excavation safety.

B. Traffic Control

- 1. Keep all roads, sidewalks and parking areas that are not part of this project usable at all times.
- 2. The Subcontractor shall provide all necessary barricades, lights, signs, signals, etc., for the protection of the workers and the public, as established by the Occupational Safety and Health Administration (OSHA) Construction Safety and Health Regulation 29 CFR, Part 1926, Subpart G, Signs, Signals and Barricades. Note that there are special requirements for barricades, traffic control, and protection for excavations over 4'-0" deep; refer to Paragraph 1.6.C, below.

C. Excavations, Trenching and Shoring

- 1. All excavations, trenching and shoring shall comply with the rules and regulations as established by OSHA Construction Safety and Health Regulations 29 CFR, Part 1926, Subpart P, Excavation, Trenching and Shoring and shall comply with the Rocky Flats Health and Safety Practices (HSP) Manual, Section HSP-12.08.
- 2. OSHA Pamphlet 2226, Excavation and Trenching Operations, can be used as an additional aid.

1.7 EXISTING UTILITIES

- A. There may be existing utilities buried within the limits of the construction area. Known existing utilities will be indicated in the IWCP and on the Drawings.
 - 1. It is a requirement to hand-excavate within 6 feet (or as directed by the Contractor) of areas where existing utilities are indicated.
 - a. Actual locations of all existing utilities within the excavation area shall be located by the Subcontractor by hand excavation.
 - b. After the actual locations and routing of the existing utilities have been found to be accurately determinable through this hand excavation, and after approval from the Contractor's Construction representative, the Subcontractor may begin excavation using machinery in a manner acceptable to the Contractor.
 - c. After excavation by machinery has begun with the approval by the Contractor, the Subcontractor continues to be fully responsible for all utilities which were found through hand excavation and/or which were indicated on the Drawings and IWCP excavation permit.
 - 2. Any existing utility indicated in the IWCP and on the Drawings which is damaged by the Subcontractor shall be immediately repaired at the Subcontractor's expense, and in a manner acceptable to the Contractor.
 - 3. If excavation will be within 10'-0" of any existing electrical utility (whether underground, overhead, or at the side of the excavation), Lockout/Tagout is required. The Subcontractor shall provide 24 hour prior notice to the Contractor so that the Contractor can arrange for and perform this Lockout/Tagout.
- B. Notify the Contractor immediately if any existing utilities which were not indicated are encountered during excavation.
- C. Obtain approval from the Contractor before backfilling existing utilities. Note that utility warning tape (provided by the Contractor) shall be placed 12" above existing utilities.

1.8 EQUIPMENT

- A. All equipment and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times.
- B. The equipment shall be adequate and shall have the capability of producing the indicated compaction requirements and other quality requirements specified herein.

1.9 SUBMITTALS: In accordance with "Section 01300 - Submittals", the Subcontractor shall submit the following as specified herein.

A. Initial Test Reports (for approval of the material prior to use):

1. Sand for Pipe Bedding and Initial Utility Backfill:

- Sieve Analysis (Paragraph 2.2.A)
- Moisture-Density Relationships (Paragraph 3.9.E)

2. Suitable Fill Material:

- Plasticity Index (Paragraph 2.2.B.1)
- Moisture-Density Relationships (Paragraph 3.9.E)

3. Gravel (or Stone) Fill Around/Beneath Fire Hydrants:

- Sieve Analysis (Paragraph 2.2.E)

4. Capillary Water Barrier Material:

- Sieve Analysis (Paragraph 2.2.F)

B. Catalog Data:

1. Vapor Barrier (Paragraph 2.3)

PART II - PRODUCTS

2.1 EXCAVATED MATERIAL

A. Material to be excavated is assumed to be earth and other materials that can be removed with a power shovel.

B. Any rock which cannot be removed as described above or other unsuitable material or unacceptable soil encountered shall be removed and disposed of by the Subcontractor in a manner acceptable to the Contractor.

1. The Subcontractor shall submit a proposal for accomplishing this removal/disposal for the Contractor's review and approval prior to the commencement of this work.

2.2 FILL MATERIALS/DEFINITIONS

A. Pipe Bedding and Initial Utility Backfill in Trenches shall be sand which passes a 20-mesh sieve and is retained on a 200-mesh sieve, when tested in accordance with ASTM C136. Sieve sizes shall conform to ASTM E11.

1. Submit initial test results indicating compliance to these requirements, prior to shipment of the material to the site.

25

B. Suitable Fill Material

1. At locations where backfill must be placed at or under structures or pavements, fill material shall be nonexpansive soils (Plasticity Index equal to or less than 12 percent when tested in accordance with ASTM D4318) which do not include soil/materials indicated in the "unsuitable materials" definition listed in Paragraph 2.2.C.
 - a. Submit test results for Plasticity Index for this fill material to be used at these locations (at or under structures or paved areas), indicating compliance to these requirements.
 - b. Note that this suitable fill material may be imported or material excavated from the site trenching/excavations if it meets the specified requirements.
2. At locations where backfill is placed within overlot site grading (not at or under structures or paved areas), fill material shall be soils which do not include soil/materials indicated in the "unsuitable materials" definition listed in Paragraph 2.2.C.

C. Unsuitable Materials include all soil materials that contain debris, roots, organic matter, frozen matter, stone or rock (with any dimension greater than 3" at areas under structures or paved areas and 6" at areas in overlot site grading), or other materials that are determined by the Contractor's representative to be unsuitable for stable, compacted backfill purposes.

D. All suitable material removed from excavations/trenching shall be used in the backfilling of the excavations/trenches prior to bringing in import suitable fill material. No excavated material shall be wasted without approval of the Contractor.

E. Gravel (or Stone) Fill Around/Beneath Fire Hydrants shall be clean washed gravel or crushed stone which passes the 1-1/2-inch sieve and is retained on the 3/4-inch sieve, when tested in accordance with ASTM C136. Sieve sizes shall conform to ASTM E11. No flaking rock or stone shall be used for this material.

1. Submit initial test results indicating compliance to these requirements, prior to shipment of the material to the site.

F. Capillary Water Barrier Materials shall be clean, crushed stone, crushed or uncrushed gravel composed of hard durable particles. When tested in accordance with ASTM C136, maximum particle size shall be 1-1/2-inch and not more than 2 percent of the particles shall be small enough to pass a No. 4 sieve. Sieve sizes shall conform to ASTM E11. No flaking rock or stone shall be used for this material.

1. The capillary water barrier shall be placed at locations indicated on the Drawings beneath slabs on grade.
2. Submit initial test results indicating compliance to these requirements, prior to shipment of the material to the site.

2.3 VAPOR BARRIER: Shall be 6-mil minimum thickness polyethylene sheeting with lapped and sealed joints. Submit catalog data for the vapor barrier to indicate compliance to these requirements.

86 84

- 2.4 **WARNING TAPE:** Furnished by Contractor and installed by Subcontractor in accordance with Project Drawings and this Section.

PART III: EXECUTION

3.1 GENERAL

- A. All streets, roads, grading, structures, utilities, and other improvements not specifically designated to be cleared, removed, stripped, or altered as a part of the work shall be protected from damage throughout the construction period. Any damage caused by the Subcontractor, his employees, agents or any lower-tiered subcontractors shall be immediately repaired to original condition at the Subcontractor's expense.
- B. In excavations and trenches, proper allowances shall be made for pipe installation, formwork, concrete work, shoring, inspection, and any other work required in the excavation. Bottoms of excavations and trenches shall be level, clean and clear of loose materials, trash and debris.
- C. Trenching for pipe installation shall be in accordance with OSHA and other safety standards referenced within these Specifications, and trenches shall be of sufficient width to facilitate laying of pipe. Undercutting will not be permitted. Trenches shall be of sufficient depth to provide not less than the minimum cover shown on the Drawings and indicated within these Specifications.
- D. Protect bottoms of all excavations from free-standing water and frost. All soils in excavations or where fills will be placed shall be protected from movement or other damage due to frost penetration.
 - 1. Soil backfill, insulation, heat, or other acceptable methods shall be used to protect soils during periods of the year in which frost penetration is possible.
- E. Suitable excavated material that is required for fill shall be separately stockpiled as directed by the Contractor.

- 3.2 **DRAINAGE:** Excavation and site grading shall be performed in such manner that the area of the site and the area immediately surrounding the site will be continually and effectively drained by gravity or by temporary pumps.

- A. Water shall not be permitted to accumulate in the excavation or adjacent to structure foundations.
- B. The excavation shall be drained by methods which will prevent wetting of the foundation bottom, undercutting of footings, or other conditions detrimental to proper construction procedures.
- C. The excavation shall be kept dry during digging, subgrade preparation, and continually thereafter until the structure to be built or installed is completed to the extent that all footings and foundation walls have been placed and foundation trenches are backfilled and no damage from hydrostatic pressure, floatation, or other causes will result.

82

3.3 SHORING AND BRACING PROTECTION

- A. Shoring and bracing protection shall be furnished and installed at all locations indicated on the Drawings and in the Specifications and as necessary to protect personnel, banks, and adjacent (both new and existing) paving, structures, footings, drilled piers, utilities, or other items on or adjacent to the site.
- B. Unless otherwise indicated or specified, shoring and bracing shall be removed as excavations are backfilled in a manner to prevent caving.

3.4 CLEARING AND GRUBBING

A. Clearing

- 1. Clearing shall consist of satisfactory disposal of vegetation designated for removal, including snags, brush, and rubbish occurring in the areas to be cleared and grubbed for the work.
- 2. Roots, brush, and other vegetation in areas to be cleared for the work shall be cut off flush with or below the original ground surface.

B. Grubbing

- 1. Grubbing shall consist of the removal and disposal of brush and matted roots from the areas required to be cleared and grubbed for the work.
- 2. Material not suitable for foundation purposes, shall be removed to a depth of not less than 18" below the original ground surface level of the ground in areas designated as construction areas under such as areas for buildings and areas to be paved.
- 3. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the required surface elevation for the work.

- C. Roots, brush, rotten wood, and other refuse from the clearing and grubbing operations shall be disposed of by the Subcontractor in accordance with Paragraph entitled "DISPOSAL OF DEBRIS AND EXCESS MATERIAL".

3.5 OVEREXCAVATION

- A. All unstable materials encountered below the established elevation of the excavation that will not provide a firm foundation for subsequent work shall be removed and replaced as directed.
- B. Excavations carried below the depths indicated or required WITHOUT SPECIFIC DIRECTION shall be returned to the proper elevation in accordance with the procedure specified herein for backfilling. All of this work shall be carried out at the Subcontractor's expense.

88 88

3.6 BACKFILLING

- A. Prior to backfilling, clean excavations of all trash and debris, and compact the trench or excavation subgrade to the requirements indicated below in Paragraph entitled "COMPACTION".
 - 1. The existing grade or subgrade to receive fill shall be scarified to a minimum depth of 6" before the fill is started, such that the subgrade will be compacted (and moistened or dried, if necessary) to meet the density/moisture requirements indicated below.
- B. Backfilling shall not begin until construction below finish grade has been approved, unless otherwise noted herein.
- C. Pipe Bedding: All piping shall be placed upon a 6-inch (*compacted thickness*) layer of sand bedding material, compacted as specified below.
- D. Initial Utility Backfill for piping, conduits or other underground utilities shall be sand, backfilled to a depth of 12 inches (*compacted thickness*) over the top of the pipe, conduit, cable, etc., and backfilled as indicated below. Refer to Project Drawings.
- E. Fill shall be placed in horizontal layers not in excess of 10-in. *compacted thickness* and shall have a moisture content as specified herein such that the required degree of compaction may be obtained. Each layer shall be compacted by hand or machine tampers or by other suitable equipment. Compaction and testing requirements shall be in accordance with the requirements indicated below.
 - 1. Note that if the Subcontractor cannot attain the compaction densities required below using 10" thick compacted lifts, then the Subcontractor shall reduce the required compacted lift thickness to 6". This reduction in lift thickness shall be done at no additional cost to the Contractor.
- F. Install Contractor-furnished utility warning tape 12 inches above new pipe and utilities and any existing underground utilities exposed during the work.
- G. Placing Fill Material
 - 1. Completed fill shall correspond to the indicated grades/elevations (see Paragraph entitled "GRADING").
 - 2. Place fill materials in successive layers of *loose* materials not more than 13" deep to achieve the specified 10" maximum compacted lift thickness. Note that if the compacted lift thickness must be reduced in accordance with Paragraph 3.6.E.1, the loose layer thickness shall not exceed 8".
 - 3. Uniformly spread each layer using approved devices and machinery.
 - 4. Fill materials shall be moistened (or dried) and thoroughly mixed as necessary to attain the moisture content indicated in Paragraph entitled "COMPACTION".
 - 5. Compact each layer of fill thoroughly using the appropriate compaction equipment. Compact each layer to the requirements indicated below.

89

6. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of the footing; the area remaining shall be compacted by power-driven hand/walk-behind tampers, compactors, or rollers suitable for the material being compacted.
 7. Backfill shall be placed carefully around pipes to avoid damage to coverings.
 8. Backfill shall not be placed against newly poured concrete walls prior to the concrete within the walls reaching its design strength.
 - a. The Subcontractor shall inform the Contractor if additional concrete cylinder samples (taken by the Contractor's testing agency or representative) are to be used for the purpose of determining if the concrete has attained the design strength prior to the cylinder test age indicated in "Section 03300 - Concrete".
 9. Backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall.
 10. Where fill or backfill is to be placed and compacted against structure walls, the walls shall be supported laterally as necessary to prevent damaging or displacing the walls. Any wall so damaged as a result of the Subcontractor's operation shall be completely and promptly replaced at no additional cost to the Contractor.
- H. Gravel or Stone Fill around and beneath fire hydrants shall be densely placed and tamped to provide a free-draining gravel or stone area around and beneath the fire hydrants as indicated on the Drawings. No compaction tests will be required for this material.
1. Ensure that the gravel is cleared out of the drain hole, there by not plugging the drain for the fire hydrant. This shall be accomplished by placing a screen or mesh over the drain hole prior to covering it with backfill.
- I. Capillary Water Barrier under concrete floor slabs on grade shall consist of the materials specified above. The capillary water barrier shall be placed directly on the subgrade after the subgrade has been approved for density and elevation requirements.
1. Compaction tests in accordance with the requirements indicated below will be required for this capillary water barrier material.
 2. Capillary water barrier shall be placed to the thickness and grade/elevations indicated on the Drawings.
- 3.7 SUBGRADE PREPARATION FOR BASE COURSE. This applies to areas which will receive base course surfacing and to areas which will receive base course and subsequent paving.
- A. Backfill of the trenches within areas to receive base course shall be performed as indicated above in Paragraph entitled "BACKFILLING", to the elevation required for placement of aggregate base course.
 - B. Backfill shall be compacted to the requirements indicated in Paragraph entitled "COMPACTION".

90 86

- C. Smoothness: This completed subgrade for the base course shall show no deviations in excess of 1" when tested with a 10-foot straightedge.
- D. Grade Tolerance: The finished surface of the completed subgrade for the base course shall be within 0.05 foot (plus/minus) of the grade/elevation required or indicated for the bottom of base course.
- E. See "Section 02240 – Aggregate Base Course" for requirements for installation of the aggregate base course.

3.8 SUBGRADE PREPARATION FOR CAPILLARY WATER BARRIER AND CONCRETE

- A. Backfill of the excavations and trenches within areas to receive capillary water barrier or concrete shall be performed as indicated above in Paragraph entitled "BACKFILLING", to the elevation required for the placement of the capillary water barrier or concrete, and as indicated on the Drawings.
- B. Backfill shall be compacted to the requirements indicated in Paragraph entitled "COMPACTION".
- C. Smoothness:
 - 1. The completed subgrade for the areas to receive capillary water barrier shall show no deviations in excess of 1" when tested with a 10-foot straightedge.
 - 2. The completed subgrade for areas to receive concrete shall show no deviations in excess of 1/2" (except for areas under footings which may have deviations up to 1") when tested with a 10-foot straightedge.
- D. Grade Tolerance: The finished surface of the completed subgrade for areas to receive capillary water barrier or concrete shall be within 0.05 foot (plus/minus) of the grade/elevation required or indicated for the bottom of capillary water barrier or concrete.
- E. See "Section 03300 – Concrete" for requirements for installation and placement of the concrete.

3.9 COMPACTION

- A. All soil materials, including sand bedding and suitable fill material, shall be compacted and tested to the requirements indicated herein.
- B. Note that hydraulic compactors attached to the backhoe boom shall not be used to compact the initial utility backfill (up to 12" above the pipe – see Drawing), since this could damage the pipe. Vibratory plate compactors or other suitable compaction equipment shall be used for the initial utility backfill.
- C. Except as otherwise specified, moisture/density relationships shall be determined by American Society for Testing and Materials (ASTM) D1557 and the degree of field compaction shall be controlled with ASTM D1556 or ASTM D2922 and moisture content shall be controlled using ASTM D3017. All tests will be performed by the Contractor or the Contractor's designated representative.

1. Compaction of 90% of maximum density will be required at all overlot site grading and at pipe bedding and initial utility backfill (see Drawings for upper limit of initial utility backfill).
2. Compaction of 95% of maximum density will be required at or under all structures or paved areas, except as noted above for the pipe bedding and initial utility backfill.
3. A minimum of one field compaction density/moisture test shall be required for each 1000 sq. ft., or portion thereof, for each lift.

D. Moisture Content

1. Backfill in overlot site grading areas (not at or under structures or pavements) will not require moisture content readings. The moisture content of the soil in these locations shall be that necessary to attain the compaction density requirements.
2. In areas where backfill is placed at or under structures or pavements, the material, except as noted below, shall be moistened (or dried, if too wet) and thoroughly mixed to attain a moisture content between 2 percent below and 4 percent above optimum moisture when compacted.
 - a. The sand used for pipe bedding and initial utility backfill and the capillary water barrier material shall be exempt from this moisture content range requirement, but should have a moisture content necessary to attain the indicated compaction density requirements.

E. The Subcontractor shall submit laboratory test results for the moisture-density relationships for the sand (pipe bedding/initial utility backfill), capillary water barrier material, and import suitable fill material (if used). These will provide the Contractor and its testing agency with the maximum density and the optimum moisture content for the respective materials to be used in the work.

F. The Contractor will pay for any test for soil compaction or moisture content that meets the requirements of the Specifications, but the Subcontractor shall pay for any soil tests that indicate the soil compaction and/or moisture content does not meet requirements of the specifications.

3.10 OVERLOT SITE GRADING

- A. Uniformly smooth grade all areas covered by the project, including excavated and backfilled sections and adjacent transition areas. The degree of finish shall be that ordinarily obtainable from blade graded operations.
- B. The finish surface shall be not more than 0.15 ft. above or below the grades/elevations indicated on the Drawings, allowing for the placement of topsoil where required and as indicated in "Section 02800 -- Topsoil and Revegetation" and on the Drawings.
- C. All drainage swales shall be restored and finished so as to drain readily.

3.11 INSTALLATION OF VAPOR BARRIER

- A. Vapor barrier shall be laid over dry or pervious surfaces to receive concrete slabs on grade as indicated on the Drawings.

92 87

- B. Edges and ends of vapor barrier material shall be lapped not less than 6 inches.
- C. Vapor barrier material damaged during subsequent work shall be patched. Patches shall be lapped as described above.
- D. Patches and lapped joints shall be sealed with a pressure sensitive adhesive or tape, not less than 2 inches wide, which is compatible with the vapor barrier sheeting material.

3.12 RECONDITIONING OF SUBGRADES

- A. Approved compacted subgrades that are disturbed by the Subcontractor's subsequent operations or adverse weather shall be scarified and compacted as specified herein to the required density and moisture limits prior to further construction thereon.
- B. Any rework due to the above actions shall be performed at no additional cost to the Contractor.

3.13 DISPOSAL OF DEBRIS AND EXCESS MATERIAL

- A. Rubble, debris, and material from trenching operations which is not suitable for fill shall be disposed of as directed by the Contractor.
- B. Excess material from excavation, unsuitable for or not required for backfilling, shall be wasted, spread and leveled or graded as directed by the Contractor.

END OF SECTION

03 12

SECTION 02600--ASPHALT CONCRETE PAVING

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. This work shall consist of a bituminous mixture constructed on the prepared foundation in accordance with these specifications and in conformity with the lines, grades, thicknesses and typical cross sections shown on the plans.
- B. Use only materials which are furnished by a bulk asphalt concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete.
- C. Do not apply soil sterilant without prior written approval by the Contractor.

1.2 SUBMITTALS

- A. Submit certification from the asphalt concrete producer that the materials furnished conforms to the job-mix formulas established within these specifications.
- B. After the project is under contract, requests made in writing by the Subcontractor for changes in the job-mix formula will be considered. The job-mix formula may be changed by the Contractor if it will produce material of equal or better quality and will result in a savings in cost to the Government through an adjustment in unit price.

- 1.3 WEATHER LIMITATIONS: Place prime coats, tack coats and asphalt concrete only when the air temperature is stable and above 40°F and when the underlying base is free from water, snow or ice.

PART II: PRODUCTS

2.1 ASPHALT CONCRETE PAVING MIX

- A. The bituminous plant mix shall be composed of a mixture of aggregate, filler if required and bituminous material. The several aggregate fractions shall be sized, uniformly graded and combined in such proportions that the resulting mixture meets the grading requirements of the job-mix formula.
- B. Aggregates for hot plant mix bituminous pavement shall be of uniform quality, composed of clean, hard, durable particles of crushed stone, crushed gravel, natural gravel or crushed slag. The aggregate shall have a percentage of wear of not more than 45 when tested in accordance with American Association of State Highway and Transportation Officials (AASHTO) T96. The material shall not contain clay balls, vegetable matter and other deleterious substances. Excess of fine material shall be wasted before crushing.
 - 1. When 25% or more of the particles in a gravel deposit are larger than the maximum size specified for the designated grading, the produced aggregate shall be considered crushed gravel. When crushed gravel is used, not less than 50% by weight of the particles retained on the No. 4 sieve shall have at least one fractured face.

2. The aggregate for the mixture shall be graded and combined in such proportions that the resulting composite blend meets the requirements of the job-mix formula for the project. The aggregate grading for the job-mix formula, with the allowable tolerance, will be within the master range set forth in the following table:

**MASTER RANGE TABLE FOR
HOT PLANT MIX BITUMINOUS PAVEMENT**

<u>Designation</u>	<u>Grading B</u>	<u>Grading C</u>	<u>Grading D</u>	<u>Grading E</u>	<u>Grading FX</u>	<u>Grading G</u>
1-1/2"	100	-	-	-	-	-
1"	77-100	-	-	-	-	100
3/4"	65-95	100	-	100	-	-
1/2"	-	70-95	100	-	100	-
3/8 "	43-76	50-88	77-100	-	-	-
#4	30-60	40-72	50-78	38-72	45-78	-
#8	20-45	28-58	35-60	25-58	30-60	45-85
#50	7-27	9-32	10-30	-	-	-
#200	3-12	3-12	3-12	3-12	3-13	5-15

- C. Filler for the job-mix formula shall conform to the requirements of AASHTO M17.
- D. Asphalt cement used in the job-mix formulas shall comply with AASHTO M20, 85-100 penetration grade or AASHTO M226, Viscosity Grade AC-10.
- E. The allowable job-mix formula tolerances shall comply with the following:

Passing No. 4 and larger sieves*	+8%
Passing No. 8 to No. 100 sieves (inclusive)	+6%
Passing No. 200 sieve	+3%
Bitumen	+0.5%
Temperature of mixture when emptied from mixer	+20°F

* Exclusive of the maximum size designed in the job-mix formula.

- F. 1. The job-mix formula shall be as follows in which the percentages shown are based on the weight of dry aggregates only:

<u>Sieve Designation</u>	<u>Percent By Weight Passing Lab Sieve</u>
1/2 in.	100
3/8 in.	-
No. 4	69
No. 8	51
No. 50	-
No. 200	9
Asphalt Binder Percentage	6.5

2. This aggregate gradation with the allowable tolerances is within Grading EX.
3. The temperature of the mixture when emptied from the mixer shall be within the following limits and as specified by the Contractor:

<u>Mixer</u>	<u>Warm Weather</u>	<u>Cold Weather</u>
Pugmill	275°F min.	325°F max.
Dryer-Drum	220°F min.	280°F max.

2.2 PRIME COAT

- A. Cutback liquid asphalt.
- B. Medium-Curing Type--AASHTO M82, Grade MC-70.

2.3 TACK COAT: Emulsified asphalt, AASHTO M-140, Grade SS-1.

PART III: EXECUTION

3.1 SURFACE PREPARATION

- A. Base Course
1. Remove loose and foreign material from compacted base course surface immediately before application of prime coat.
2. Do not displace base course material.

B. Existing Paved Surfaces

1. All existing pavements to be overlaid with asphalt concrete shall be cleaned with a mechanical sweeper or other methods approved by the Contractor immediately before placing the tack coat.
2. Areas not accessible with a mechanical sweeper shall be cleaned by other methods as approved by the Contractor.
3. All transverse and longitudinal cracks in the existing paved surface shall be sealed before placing the tack coat. Cracks shall be cleaned with a stiff broom and, if available, compressed air. Fill each crack with liquid asphalt prime coat material and apply fine, clean and dry sand to the surface. Larger cracks that cannot be filled with liquid asphalt alone shall be filled with alternating layers of asphalt and sand. Allow to dry until the surface is no longer tacky or, as directed by the Contractor, before placing the tack coat.
4. Edge failures along paved surfaces to be overlaid shall be repaired. Remove all broken material and shape the hole evenly with straight vertical edges. Replace all unstable base with approved base course material and compact to the specified density for base courses. Complete the repair by priming the base and placing a minimum of 2 in. of compacted asphalt concrete. The finished surface shall be flush with the original pavement surface.

3.2 PRIME AND TACK COAT APPLICATIONS

A. Prime Coat

1. Uniformly apply at rate of 0.25 to 0.50 gal/yd.² over compacted and clean base course surface. Apply at a material temperature between 105°F and 175°F.
2. Apply enough material to penetrate and seal but not flood surface.
3. Allow until the surface is no longer tacky or as directed by the Contractor. Prime coat shall be entirely absorbed by the base material within 24 hr. after application.

- B. Tack Coat**—Emulsified asphalt tack coat shall be applied to all pavement surfaces that receive an overlay of asphalt concrete. The rate of application shall be from 0.03 to 0.15 gal/yd.². Flooding will not be allowed.

3.3 PREPARING PAVING MIX

- A. The aggregates shall be combined in the mixer in the amount of each fraction of aggregates required to meet the job-mix formula. The bituminous material shall be measured or gaged and introduced into the mixer in the amount specified by the job-mix formula.
- B. After the required amounts of aggregate and bituminous material have been introduced into the mixer, the materials shall be mixed until a complete and uniform coating of the particles is secured.

97

- C. Paving asphalt shall be added to the aggregate when the temperature of each ingredient is from 275°F to 325°F for pugmill mixtures. The temperature differential between each ingredient shall be no more than 35°F.
- D. Mixtures shall not be delivered for use on the road at less than 260°F nor greater than 320°F for pugmill mixtures and at not less than 200°F nor greater than 275°F for dryer-drum mixtures. Should the temperature be too high for proper compaction, the Subcontractor will be required to wait until the mixture has cooled to a reasonable rolling temperature.

3.4 TRANSPORTING PAVING MIX

- A. The paving mixture shall be transported from the producer's plant to the jobsite in tight, clean, smooth metal-bed trucks. Truck beds shall be thinly coated with a minimum amount of paraffin oil or other approved material to prevent the mixture from adhering to the beds.
- B. Each truck shall be equipped with a cover of canvas or other suitable material. When directed by the Contractor, the covers shall be used to protect the mixture from the weather and to help maintain the required delivery temperature.
- C. No load shall be delivered so late in the day as to interfere with spreading and compacting the mixture during the scheduled working hours.

3.5 PLACING PAVING MIX

- A. The asphalt concrete mixture shall be placed in a one lift thickness as indicated on the drawings.
- B. Place asphalt concrete mixture on prepared surface, spread and strike off using a self-powered paving machine equipped with thickness and screed controls.
- C. Areas inaccessible with a self-powered spreader may be hand-placed or with a spreader box as directed by the Contractor.
- D. Place at a thickness so that when compacted it will conform to the indicated grade, cross section, finish thickness and density indicated.
- E. Begin placing along centerline of areas to be paved on crowned section and at high side of sections on one-way slope.
- F. Longitudinal joints shall have same texture, density and smoothness as adjacent sections. Longitudinal joints shall be trimmed to a vertical face and to a neat line if the edges of the previously laid surfacing are, in the opinion of the Contractor, in such condition that the quality of the completed joint will be affected.
- G. Before placing the finish layer adjacent to cold transverse construction joints, such joints shall be trimmed to a vertical face and to a neat line. Transverse joints shall be tested with a 10-ft. straight-edge and shall be cut back as required to conform to the requirements specified in paragraph 3.9.B entitled "Tolerances."

3.6 ROLLING EQUIPMENT

- A. Rolling of the paving material shall be accomplished by a steel wheel roller and pneumatic tire roller, each being self-powered.
- B.
 - 1. Three-wheel steel-tired rollers shall weigh not less than 12 T, with a compression on the rear wheels of not less than 325 pounds per linear inch of tire width.
 - 2. Three-axle steel-tired tandem rollers shall weigh not less than 12 T. Two-axle steel-tired tandem rollers shall weigh not less than 10 T. Rollers used for initial or breakdown rolling shall be equipped with rolling wheels having a diameter of 40 in. or more.
- C.
 - 1. Pneumatic-tired rollers shall be the oscillating type having a width of not less than 4 ft. and equipped with pneumatic tires of equal size and diameter, having treads satisfactory to the Contractor. Wobble-wheel rollers will not be permitted. The tires shall be so spaced that the gap between adjacent tires will be covered by the tread of the following tire or shall be so spaced that any resulting uncovered gap will not exceed 1-1/2 in. in width when the tires are inflated to 90 psi and the operating weight is 2,000 lb. per tire.
 - 2. The tires shall be inflated to 90 psi or such lower pressure as designated by the Contractor and maintained so that the air pressure will not vary more than 5 psi from the designated pressure. Pneumatic-tired rollers shall be so constructed that the total weight of the roller can be varied to produce an operating weight per tire of not less than 2,000 lb. The total operating weight of the roller shall be varied as directed by the Contractor.
- D. The rolling equipment shall be in good operating condition and shall be capable of reversing without backlash.

3.7 COMPACTING PAVING MIX

- A. After the bituminous mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling.
- B. The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking or shoving.
- C. If displacement, cracking or shoving occurs, it should be immediately corrected by raking and the addition of fresh mixture when required.
- D. The initial or breakdown rolling shall be with a steel-wheeled roller. On the initial pass, the roller shall be operated with the drive wheels in the forward position with respect to the direction of spreading operations. The reversal path of the initial or breakdown rolling shall follow the path of the previous forward rolling.
- E. Unless otherwise directed, rolling shall begin at the sides and proceed longitudinally parallel to the road centerline, each trip overlapping one-half the roller width, gradually progressing to the crown of the road. This pattern shall be repeated and continued until the required compaction is obtained.

99

- F. Intermediate rolling with a pneumatic tire roller shall follow the initial rolling as closely as possible to ensure maximum impermeability. The pneumatic rolling shall be accomplished while the mixture temperature is at or above 150°F.
- G. The rolling pattern of the pneumatic roller shall be the same as the steel-wheeled roller.
- H. Rolling shall be performed so that points where roller direction is reversed will not be in a transverse line across the spread. The reversal points for each roller pass shall be either ahead of or to the rear of the reversal point of the previous pass.
- I. Rolling shall be continuous from the time of the initial rolling until the specified density has been obtained.
- J. Final rolling shall be with a steel-wheeled roller and shall eliminate all previous roller marks.
- K. Areas not accessible with rolling equipment shall be compacted with hot hand tampers or vibrating plate compactors as approved by the Contractor.

3.8 PAVEMENT DENSITY

- A. Minimum density shall be 96% of a laboratory specimen made in the proportions of the job-mix formula.
- B. Field density determinations will be made in accordance with American Society for Testing and Materials (ASTM) D2950.

3.9 GRADE CONTROL

A. Procedure

- 1. The Subcontractor shall be responsible for control of all finished grades.
- 2. The Subcontractor shall submit to the Contractor for approval grade elevations taken at 50-ft. stations along the centerline of all new and reconstructed roadways and at other points as directed. Grade-control procedures will be conducted upon completion of the surface lift of asphalt paving for each roadway section.
- 3. All humps and depressions exceeding the specified tolerance shall be corrected as directed.
- 4. The grade control procedures shall be conducted in a manner that will not delay the progress of the project.
- 5. The Contractor will retain a copy of the approved grades as a part of the project records.
- 6. Obtain written approval from the Contractor before proceeding with the work.

- B. Tolerances--The finished surface of the asphalt paving shall not vary above or below the lines, grades and typical sections shown on the drawing by more than 0.03 ft.

END OF SECTION

SECTION 03350-CONCRETE

PART I: GENERAL

- 1.1 **APPROVALS:** Obtain written approval from the Contractor at least 24 hours before each individual concrete placement is made.
- 1.2 **ENVIRONMENTAL CONDITIONS**
- A. Whenever air temperature is below 40°F, special precautions shall be taken to protect concrete from freezing. Procedures to be used shall be the responsibility of the Subcontractor and shall conform to American Concrete Institute (ACI) 306.
- B. Whenever air temperature is 85°F or higher during concrete placement, special precautions shall be taken to prevent concrete from drying and setting too rapidly. Procedures to be used shall be the responsibility of the Subcontractor and shall conform to ACI 305.

PART II: PRODUCTS

2.1 **MATERIALS**

- A. Cement
1. Portland Cement: Conform to American Society for Testing and Materials (ASTM) C150, Type I, unless specifically noted otherwise on the drawings.
 2. Air-Entraining Portland Cement: Conform to ASTM C150, Type IA or IIA, low alkali.
 3. High Early Strength Portland Cement: Conform to ASTM C150, Type III.
- B. Aggregate for Regular-Weight Concrete--Conform to ASTM C33.
- C. Water--Clean and potable.
- D. Reinforcing
1. Reinforcing Bars: Conform to ASTM A615, Grade 40 and/or Grade 60.
 2. Mesh Reinforcing: Conform to ASTM A185.
- E. Admixtures--Concrete admixtures shall be approved by the Contractor prior to their use.
- F. Premolded Expansion Joints--Conform to ASTM D1752 for vertical applications ASTM D1751 for horizontal applications.

G. Curing Materials

1. Liquid Membrane: ASTM C309, Type 2.
2. Sheet Material: ASTM C171, Type 1.1.1, white; Type 1.1.2, white opaque; and Type 1.1.3.

2.2 PROPORTIONING OF CONCRETE

- A. Ready-mix concrete shall conform to ASTM C94, including other specifications mentioned therein and the requirements of this specification. Concrete shall have a minimum compressive strength of 3,000 psi at 28 days unless otherwise noted on drawings.

2.3 MIXING OF CONCRETE: Ready-mix concrete shall be mixed and delivered in accordance with ASTM C94.

2.4 SAMPLES AND TESTING

- A. Concrete tests shall be the responsibility of the Contractor. The Subcontractor shall provide assistance in obtaining test samples.
- B. Concrete test cylinders shall be made in accordance with ASTM C31 and tested in accordance with ASTM C39.

PART III: EXECUTION

3.1 FORMING

- A. Formwork shall be in accordance with ACI 301, ACI 347 and ACI 318.
- B. Forms shall conform to the shape, lines and dimensions of the members as called for on the drawings and shall be constructed on panels of the largest size practical in keeping with the size of the formed member.
- C. The face of any excavation shall not be used as forming unless otherwise noted on the drawings or in these specifications.
- D. Form ties shall be the rod type that provide a break 1 1/2 in. back from the concrete surface, leaving a neat hole to be grouted.
- E. Exposed corners shall be formed with 3/4 in. chamfers except for corners which edging is specified.
- F. Install construction joints only where shown or noted on the drawings. Additional joints may be used only with the approval of the Contractor.
- G. Shoring shall be sufficient to maintain the desired alignment of forms and to support construction loads.

3.2 PLACING OF REINFORCING

- A. Placement of reinforcing shall be in accordance with ACI 301 and 318 and the Manual of Standard Practice of the Concrete Reinforcing Steel Institute.**
- B. Do not use bars less than 3/8 in. diameter (No. 3) except for stirrups, ties and distribution steel.**

3.3 PREPARATION FOR PLACING CONCRETE

- A. Remove water from excavations.**
- B. Remove hardened concrete, wood chips, ice and other debris from the interior of forms.**
- C. Forms shall be oiled or wetted with water prior to placing the concrete.**
- D. Reinforcing shall be cleaned, secured in position, inspected and approved by the Contractor in writing before the placing of concrete.**

3.4 PLACING CONCRETE

- A. Concrete shall be placed in accordance with ACI 301, ACI 304 and ACI 318.**
- B. Place concrete in forms within 90 min. from time of introduction of cement and water to mixer.**
- C. Immediately after depositing, compact the concrete by vibrating the plastic mass in a manner approved by the Contractor that will fill air pockets and work the mixture into corners and around reinforcing and inserts.**
- D. Exposed unformed faces of concrete shall be brought to uniform surfaces and worked with suitable tools to a reasonably smooth wood float or steel trowel finish.**
- E. Remove forms in such a manner as to ensure the complete safety of the structure. Forms on vertical surfaces may be removed 24 hrs. after the concrete has been placed when approved by the Contractor.**

3.5 CURING: Concrete shall be protected against the loss of moisture for at least 7 days by the use of any of the following methods:

- A. Application of a Curing Compound**
 - 1. Apply according to the manufacturer's recommendations.**
 - 2. Do not use a curing compound on a concrete surface to which future concrete will be bonded.**
- B. For horizontal surfaces, sheet material lapped at least 4 in. and fastened or sealed in place.**
- C. Leave the forms in place for vertical surfaces.**


3.6 PATCHING

- A. Immediately after removal of forms, remove all fins and loose material.
- B. Fill chip and form tie holes with neat cement grout flush to adjacent surface.

END OF SECTION

104

Rocky Flats Plant
1-B37-HSP-12.08
REVISION 0
EXCAVATIONS AND TRENCHING

APPROVED BY:  / H. P. Mann 10/14/92
General Manager, Rocky Flats Plant Print Name Date

Responsible Organization: Occupational Safety Effective Date: October 20, 1992

CONCURRENCE BY THE FOLLOWING DISCIPLINES IS DOCUMENTED IN THE PROCEDURE HISTORY FILE:

Administration and Planning
Engineering and Technology
Environmental Restoration Management
Environmental and Waste Management
Facility Management and Operations
Maintenance and Plant Support
Performance Based Training
Safety, Safeguards, and Security
Standards, Audits, and Assurance
Transition Management

USE CATEGORY 3

ORC review # SORC 93-62 07/27/93

The following have been incorporated in this revision:
92-PRR-000662

Reviewed for Classification/UCNI

By M. J. Hyatt-X-
Date 07-14-93 gsh

This practice supersedes HSP 12.08, revision date 07/01/91.

EXCAVATIONS AND
TRENCHING

10/29/93

1-B37-HSP-12.08
REVISION 0
PAGE 2

LIST OF EFFECTIVE PAGES

<u>Pages</u>	<u>Effective Date</u>	<u>Change Number</u>
1-28	10/29/93	

TOTAL NUMBER OF PAGES: 28

106
105

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
TITLE PAGE	1
LIST OF EFFECTIVE PAGES	2
TABLE OF CONTENTS	3
1. PURPOSE	5
2. SCOPE	5
3. DEFINITIONS AND ACRONYMS	5
3.1 Definitions	5
3.2 Acronyms	8
4. RESPONSIBILITIES	8
4.1 Construction Coordinator (may be Maintenance Supervisor)	8
4.2 Environmental Restoration Management	9
4.3 Excavation Specialist	10
4.4 Excavator	10
4.5 Flagperson	10
4.6 Industrial Hygiene	10
4.7 Occupational Safety	11
4.8 Radiological Engineering	12
4.9 Radiological Operations	12
4.10 Requester	12
5. REQUIREMENTS	13
6. INSTRUCTIONS	14
6.1 Required Documentation	14
6.2 Underground Installations (Utility Installations)	14
6.3 Confined Spaces	16
6.4 Access and Egress	16
6.5 Exposure to Vehicular Traffic	16
6.6 Exposure to Hazardous Materials	17
6.7 Encountering Unusual Substances or Unidentified Objects	17
6.8 Protection from the Hazards of Water Accumulations	17
6.9 Protection of Employees from Loose Rock and Soils	18
6.10 Inspections	18
6.11 Protection of Employees in Excavations	19
6.12 Notifications	20
6.13 PPE	21
6.14 Excavating in or Near IHSS	21
6.15 Excavating with Heavy Equipment	22
6.16 PPCD	22
7. RECORDS	23
8. REFERENCES	23

TABLE OF CONTENTS (continued)

<u>Section</u>	<u>Page</u>
<u>Appendices</u>	
Appendix 1, Soil Disturbance Evaluation Form	24
Appendix 2, Competent Person Excavation and Trenching Inspection Checklist	25
Appendix 3, Land Use Request	28

108
~~106~~

1. PURPOSE

This practice defines the responsibilities and minimum safety requirements for performing excavations and trenching at Rocky Flats Plant (RFP) in accordance with 29 Code of Federal Regulations (CFR) 1926, Subpart P, Excavations.

2. SCOPE

This practice applies to all employees of site contractors and subcontractors.

This revision is a total rewrite and revision bars are omitted.

3. DEFINITIONS AND ACRONYMS

3.1 Definitions

Accepted Engineering Practices. Those requirements which are compatible with standards of practice required by a Registered Professional Engineer.

Benching. Method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal level or steps with vertical or near vertical surfaces between levels.

Cave-in. Separation of a mass of soil or rock from the side of an excavation and its sudden movement into the excavation by falling or sliding, in sufficient quantity to entrap, bury, or otherwise injure and immobilize a person.

Competent Person. One who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. A Competent Person is provided by the subcontractor for excavation and trenching activities performed under a subcontract. An EG&G Competent Person has subcontractor oversight responsibilities for excavation and trenching activities.

Excavation. Any man-made cut, cavity, trench, or depression in an earth

3.1 Definitions (continued)

Excavator. Individual involved in the physical aspects of soil disturbance.

Faces or Sides. The vertical or inclined earth surfaces formed as a result of excavation work.

Failure. A breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous Atmosphere. An atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Individual Hazardous Substance Site (IHSS) [Formerly Designated Solid Waste Management Unit (SWMU)]. An individual location on the RFP where hazardous substances, including hazardous waste and solid waste, have or may have been placed, either planned or unplanned.

Kickout. The accidental release or failure of a crossbrace.

Nonconformance Report (NCR). A written report detailing a deficiency in characteristic, documentation, or procedure which renders the quality of an item or activity unacceptable or indeterminate.

Operable Unit (OU). Groupings of individual hazardous substance sites into a single management area.

Protective System. A method of protecting employees from cave-in, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems which provide the necessary protection.

110

3.1 Definitions (continued)

Registered Professional Engineer (PE). A person who is registered as a professional engineer in the state where the work is being performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" when approving designs for manufactured protective systems or tabulated data to be used in interstate commerce.

Sloping. A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as soil type, environmental conditions of exposure, and application of surcharge loads.

Soils Disturbance Package. Includes controlled engineering documents and drawings showing the specific excavation or trench location, a written scope of work and other information necessary for conducting excavation and trenching activities in a safe manner. This package is included as an appendix to the Integrated Work Control Program (IWCP) work package or Environmental Standard Operating Procedures that have been developed for excavations and trenching.

Spoil. Soil which is removed from the excavation.

Stable Rock. Natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed.

Support System. A structure such as underpinning, bracing, or shoring, which supplies support to an adjacent structure, underground installation, or the sides of an excavation.

Trench. A narrow excavation (in relation to the length) made below the surface of the ground, the depth being greater than the width, but the width not greater than 15 ft.

11

3.2 ACRONYMS

CDH	Colorado Department of Health
CFR	Code of Federal Regulations
E&WM	Environmental and Waste Management
EPA	Environmental Protection Agency
ERM	Environmental Restoration Management
FOM	Facilities Operations Management
GFCI	Ground Fault Circuit Interrupter
HSP	Health and Safety Practice
IHSS	Individual Hazardous Substance Site
IRA	Interim Remedial Action
IWCP	Integrated Work Control Program
JSA	Job Safety Analyses
NCR	Nonconformance Report
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PPCD	Plan for Prevention of Contaminant Dispersion
PPE	Personal Protective Equipment
RCRA	Resource Conservation and Recovery Act
RE	Radiological Engineering
RFP	Rocky Flats Plant
RI	Remedial Investigation
RWP	Radiation Work Permit
SOP	Standard Operating Procedure
SWMU	Solid Waste Management Unit

4. RESPONSIBILITIES

4.1 Construction Coordinator (may be Maintenance Supervisor)

Contacts the Excavation Specialist, Occupational Safety, Industrial Hygiene, and Environmental Restoration Management (ERM) if any liquid or unidentified obstructions are encountered.

4.1 Construction Coordinator (may be Maintenance Supervisor) (continued)

Notifies Wackenhut Services, Inc. through Dispatch, the Fire Department, Occupational Safety, and Industrial Hygiene of pending or planned excavations or trenching, road closure or blockage, restricted access to building entrances, and of applicable safety considerations.

Inspects the excavation areas, and ensures that proper barricades are in place.

Performs as a first-line (field) inspector to ensure that work is performed in accordance with Occupational Safety and Health Administration (OSHA) standards and plant policies and procedures.

Ensures that subcontractors understand and meet all requirements before the start of any excavation.

Performs as an EG&G Competent Person.

4.2 Environmental Restoration Management

Determines if any proposed construction activities will impact designated IHSSs.

Provides guidance for preparation of ERM sampling plans.

Directs sampling and laboratory analysis to satisfy ERM responsibilities to the Environmental Protection Agency and Colorado Department of Health.

Provides applicable sample analysis and backgrounds information on IHSSs to Radiological Engineering (RE), and information to Industrial Hygiene so that proper Personal Protective Equipment (PPE) and other work controls can be initiated prior to excavation.

Stipulates the requirements for implementation and compliance with the Plan for Prevention of Contaminant Dispersion (PPCD) as it may be related to

4.3 Excavation Specialist

Ensures that a soil disturbance package is properly completed.

Performs pre-entry and daily inspections of excavations.

Identifies known utilities and hazardous conditions which may be encountered during excavation, at the pre-evolution meeting.

Informs trenching and excavation personnel of requirements to comply with 29 CFR 1926, Subpart P, and RFP site-specific requirements.

Inspects the excavation sites for overhead and underground utilities, and has locations indicated in the Soil Disturbance Package.

Directs excavation and trenching activities which have been interrupted because of safety concerns.

Performs as an EG&G Competent Person.

4.4 Excavator

Complies with the provisions of this practice.

4.5 Flagperson

Wears approved warning vests.

Directs traffic.

4.6 Industrial Hygiene

Recommends engineering and/or administrative controls necessary to minimize potential exposure to hazardous materials.

Ensures that PPE requirements for soil disturbances have been defined in the IWCP or Environmental Standard Operating Procedure (SOP).

114

4.6 Industrial Hygiene (continued)

Ensures that monitoring requirements necessary during soil disturbances have been addressed and are performed.

Defines, in conjunction with Occupational Safety, confined space requirements as they may relate to excavating and trenching.

Performs investigations as required when unusual substances or unidentified objects are encountered during soil disturbances.

Outlines the potential hazards associated with soil disturbances in or near an IHSS.

4.7 Occupational Safety

Develops and periodically revises this procedure which ensures the compliance with applicable 29 CFR, Parts 1910 and 1926 standards.

Performs pre-entry and daily inspections of excavations.

Monitors the excavations for compliance with safety requirements.

Provides assistance to management in determining appropriate safety requirements for excavations.

Inspects all trenching and excavation activities for compliance with safe work practices.

Defines, in conjunction with Industrial Hygiene, confined space requirements as they relate to excavating and trenching.

Performs as an EG&G Competent Person.

115

4.8 Radiological Engineering

Recommends engineering and/or administrative controls necessary to minimize potential exposure to radioactive materials.

Ensures that PPE requirements for soil disturbances have been defined in the IWCP, Environmental SOP, or Radiological Work Permit (RWP), if required.

Determines the ~~radiological monitoring requirements~~ necessary during soil disturbances, and ensures that these requirements have been defined in the IWCP, Environmental SOP, or RWP.

Determines the need for supplemental air, soil, or water radiological sampling.

Performs investigations as requested, when unusual substances or unidentified objects are encountered during soil disturbances.

4.9 Radiological Operations

Provide discipline specific input, as required, on excavations when unusual substances or unidentified objects are encountered.

4.10 Requester

Coordinates all excavation work with the Excavation Specialist.

Provides all required excavation submittals to the Excavation Specialist.

116

5. REQUIREMENTS

All employees of site contractors and subcontractors shall comply with
29 CFR 1926, Subpart P, and additional RFP requirements.

6. INSTRUCTIONS

Excavations and trenching activities are performed under the IWCP program except for ERM/Facilities Operations Management (FOM) which are performed in accordance with Environmental SOPs.

IWCPs and Environmental SOPs will be written to comply with the provisions of this practice.

6.1 Required Documentation

NOTE *Occupational Safety may require a Job Safety Analysis (JSA) which is to meet all of the criteria established by HSP 2.11, Job Safety Analysis.*

Requester

- [1] Provide the Excavation Specialist with all required excavation submittals:
 - Soil Disturbance Evaluation Form, Appendix 1
 - Controlled engineering documents and/or drawings showing specific location(s) of the proposed excavation work
 - Written scope of all proposed excavation work
- [2] Ensure that the submittals are made a minimum of 2 weeks (10 working days) before the start of work, except in emergency situations such as a water line break.

Excavation Specialist

- [3] Ensure the completion of the Soil Disturbance package.
- [4] Ensure the Soil Disturbance package is included as an appendix to the IWCP Work Package or Environmental SOP.

6.2 Underground Installations (Utility Installations)

Excavation Specialist

- [1] Plainly state, paint, or mark the location of known underground installations (utilities) before starting work.

118

6.2 Underground Installations (Utility Installations) (continued)

- [2] Indicate the type of underground installation and approximate depth on the marking stakes, or document in the Soil Disturbance package.

NOTE 1 *Picks, paving breakers, or earth-moving equipment are not to be used within a 3-ft radius of identified buried utilities, unless determined otherwise by the Excavation Specialist. Hand-held shovels must be used to locate underground installations.*

NOTE 2 *This section applies equally to above-ground and below-ground utility installations.*

Excavator

- [3] IF excavation equipment is to work within 10 ft of high voltage electrical service,
THEN ensure the electric service is de-energized.
- [4] IF excavation equipment is to work within 10 ft of high pressure gas and/or steam lines, or process waste lines,
THEN ensure the high pressure gas and/or steam lines, or process waste lines are de-energized when required.
- [5] IF unidentified utilities or damage to utilities occurs during an excavation,
THEN:
- [A] Immediately stop work.
- [B] Remove personnel from the point of hazard and barricade the area.
- [C] Immediately notify the Excavation Specialist, Occupational Safety, Industrial Hygiene, and Engineering and Technology.

6.3 Confined Spaces

NOTE *The criteria used for confined spaces will be 1-15510-HSP-6.04, Confined Space Entry Program in the HSP and 29 CFR 1910.146, Permit Required Confined Space.*

Industrial Hygiene and Occupational Safety

- [1] Identify excavations which are to be regulated as a confined space.

6.4 Access and Egress

Excavator

- [1] Extend ladders from the bottom of the trench or excavation to at least 3 ft above the surface of the ground, and secure to prevent movement.

6.5 Exposure to Vehicular Traffic

Excavator

- [1] Restrict the movement of vehicles and equipment from the area of an excavation by use of barricades.
- [2] Use a flagperson to direct both the flow of traffic and the movement of excavation equipment where barricades are not used.

Flagpersons

- [3] Wear approved warning vests.
- [4] Directs traffic around or away from any excavation or trenching operations.

6.6 Exposure to Hazardous Materials

Industrial Hygiene

- [1] WHEN the potential for hazardous materials may exist,
 THEN:

- [A] Determine and coordinate the testing of excavations for hazardous atmospheres.
- [B] Monitor air quality in the excavation, as required.
- [C] Determine the need, and specify PPE required for personnel.

6.7 Encountering Unusual Substances or Unidentified Objects

Excavator

- [1] WHEN unusual substances or unidentified objects such as: odors, liquids, broken or leaking pipes, discolored soil, are encountered within the excavation,
 THEN stop work and notify the following:
- Excavation Specialist
 - Radiological Operations
 - Industrial Hygiene
 - Occupational Safety
 - ERM
 - Engineering and Technology

6.8 Protection from the Hazards of Water Accumulations

Excavator

- [1] IF water is accumulating or has accumulated in the excavation,
 THEN stop work and notify the following before work on the excavation proceeds:
- Excavation Specialist
 - Occupational Safety
 - Industrial Hygiene

121

6.9 Protection of Employees from Loose Rock and Soils

Excavator

- [1] Place the spoil from any excavation at least 2 ft from the edge of the excavation on one side, and at least 4 ft from the edge on the other side of the excavation.

6.10 Inspections

NOTE *For excavation and trenching activities performed by a subcontractor, both EG&G and subcontractors have designated Excavation Competent Persons. An EG&G Competent Person has the ultimate authority and control of excavations, and does a daily inspection which determines whether or not the subcontractor may enter an excavation.*

Excavation Specialist or Occupational Safety

- [1] Thoroughly inspect the site to be excavated before starting an excavation to determine if conditions (such as, hazardous atmospheres, soil conditions, traffic patterns, utilities) require special safety measures.
- [2] Inspect excavations before the initial entry by personnel.
- [3] Inspect excavations and trenches daily, to determine potentials for:
 - Cave-ins or slides.
 - Indications of protective systems failure.
 - The presence of hazardous atmospheres.
 - Other hazardous conditions.
- [4] Complete the Competent Person Excavation and Trenching Inspection Checklist, Appendix 2.

6.10 Inspections (continued)

NOTE *A competent person must be present when soil is being disturbed.*

Excavator Competent Person

- [5] Inspect excavations and trenches daily, to determine potentials for:
 - Cave-ins or slides.
 - Indications of protective systems failure.
 - The presence of hazardous atmospheres.
 - Other hazardous conditions.
- [6] Complete the Competent Person Inspection and Trenching Checklist, Appendix 2.
- [7] Inspect at the start of the work shift and, as needed, throughout the shift.

NOTE *For subcontract excavation and trenching activities, the subcontractor provides the inspection checklist to the Construction Coordinator the day the inspection checklist is completed.*

Construction Coordinator

- [8] Incorporate the Competent Person Excavation and Trenching Inspection Checklist into the IWCP work package or Environmental SOP.

Competent Persons, Supervision, Excavators

- [9] IF unsafe conditions are detected during the inspection,
THEN stop work in the area until the necessary precautions have
been taken to ensure worker safety.

6.11 Protection of Employees in Excavations

Each employee in an excavation must be protected by a protective system, except when the excavation is in solid rock or the excavation is less than 4 ft deep and examination of the ground by the competent person provides no indication of a potential cave-in or slide.

6.11 Protection of Employees in Excavations (continued)

Competent Person

- [1] Determine the protection that may be required in excavations less than 4 ft because of soil conditions and the scope of work to be performed in the excavation.

6.12 Notifications

NOTE *A Land Use Request Form (RF-46427), Appendix 3 is required for any work activity in the Buffer Zone. ERMIFOM is to be notified at least 2 weeks (10 working days) before work in the Buffer Zone.*

Excavator

- [1] Notify the Fire Department in the case of:
 - Fire.
 - Detection of a hazardous or suspected hazardous atmosphere.
 - Cave-in.
 - Medical emergency.

Construction Coordinator

- [2] IF excavations have the potential to impede access to buildings, structures, roadways, Fire Department connections, or hydrants,
THEN notify the Fire Department.
- [3] WHEN water is encountered during an excavation,
THEN notify ERM.
- [4] Notify Industrial Hygiene when unusual substances or unidentified objects are encountered during soil disturbances.

6.13 **PPE**

NOTE *The use of PPE is required for all personnel within the boundaries of the excavation and trenching site, when engineering and/or administrative controls are insufficient to prevent worker exposure to hazardous materials or as specified by Industrial Hygiene or Occupational Safety.*

Excavator .

- [1] Wear the following at all times during construction activities within the construction area:
 - Hard hats.
 - Safety glasses with fixed-side shields.
 - Toe protection.
- [2] Wear hearing protection devices when noise levels exceed 85 dBA.
- [3] Wear PPE as indicated on the:
 - RWP.
 - TWCP.
 - Environmental SOP.
 - JSA.

6.14 **Excavating in or Near IHSS**

NOTE 1 *Examples of excavation in an IHSS include, but are not limited to, the scraping of surface soil, collecting of soil samples, and the driving of survey stakes or ground rods.*

NOTE 2 *A Health and Safety Plan is required for all excavations on or in an IHSS.*

ERM

- [1] Research the description of the IHSS (formerly SWMU) unit to obtain information on known or potential site hazards.

125

6.14 Excavating in or Near IHSS (continued)

- [2] Complete a Health and Safety Plan that is approved by Industrial Hygiene in accordance with the Environmental Remediation Management Sitewide Health and Safety Plan.

6.15 Excavating with Heavy Equipment

Competent Person or Excavation Specialist

- [1] Determine if a second person is necessary to monitor the operation.

Second Person (Spotter) and Operator

- [2] WHEN an excavation is being performed using heavy equipment,
THEN monitor the operation by standing within viewing distance of the excavation.

6.16 PPCD

Excavation activities occurring during Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation and Interim Remedial Action at RFP may require compliance with the PPCD. Appropriate contaminant dispersion control measures may be required. Control measures required may include:

- Wind speed measurements.
- Water spray soil applications.
- Moisture testing.
- Waste pile covering.
- Air monitoring using real time total suspended particulate capabilities.
- General administrative control measures such as vehicular speed limitations.

ERM

- [1] Determine the PPCD applicability as it may relate to excavations in accordance with the PPCD.

6.16 PPCD (continued)

Construction Coordinator

- [2] Ensure the implementation and compliance with PPCD as it may relate to excavations.

For Environmental projects, the ERM Project Manager is responsible for compliance.

7. RECORDS

Construction Coordinator

- [1] Retain all information pertinent to the excavation portion of a project in the IWCP work package or Environmental SOP.
- [2] Transfer to the Operations Manager.

Operations Manager

- [3] Maintain and disposition excavation information as a quality assurance record in accordance with 1-77000-RM-001, Records Management Guidance for Records Sources, upon project completion.

8. REFERENCES

Environmental Remediation Management Sitewide Health and Safety Plan

HSP 2.11, Job Safety Analysis

1-15310-HSP-6.04, Confined Space Entry Program

1-77000-RM-001, Records Management Guidance for Records Sources

29 CFR 1910.146, Permit Required Confined Space

29 CFR 1926, Subpart P, Excavations

APPENDIX 1

Page 1 of 1

SOIL DISTURBANCE EVALUATION FORM

The purpose of this information is to assist the committee in identifying the potential hazard (s) associated with this soil disturbance.

REQUESTER: Name _____

Group _____ Phone/Pager _____

PROJECT TITLE: _____ CHARGE #: _____

Will the disturbance occur in or near an Individual Hazardous Substance Site (IHSS, formerly SWMU)?

Are overhead utilities present?

Yes ☐ No ☐

Are underground utilities present?

Yes ☐ No ☐

Will a utility outage be required?

Yes ☐ No ☐

IS THE EXCAVATION FOR:

Construction ☐ Trenching ☐ Sampling ☐ Driven rods/posts ☐

Grounding ☐ Post holes ☐ Other types ☐

IF SAMPLING:

Soil removal by hand? Yes ☐ No ☐

Drilling? Yes ☐ No ☐

Depth of drilling _____ Diameter _____

IF CONSTRUCTION:

Hand digging only? Yes ☐ No ☐

Will mechanical equipment be required? Yes ☐ No ☐

What Type? _____

Depth of excavation _____ Length of excavation _____

Width of excavation _____ Will shoring be required _____

Requester shall fill out this form and submit it along with information required in SOIL DISTURBANCE GUIDELINE to EXCAVATION SPECIALIST.

EXCAVATIONS AND
TRENCHING

10/29/93

1-B37-HSP-12.08
REVISION 0
PAGE 25

APPENDIX 2

Page 1 of 3

COMPETENT PERSON EXCAVATION AND TRENCHING INSPECTION
CHECKLIST

Date: _____ Location: _____

Competent Person performing inspection (print): _____

Signature of Competent Person performing inspection _____

INSTRUCTIONS:

Initial Inspection: Complete Part 1 and 2.

Daily Inspection: Complete Part 2.

Type Inspection (check one): Initial _____ Daily _____

PART 1

- ☐ Visual Test _____ (Type)
- ☐ Manual Test _____ (Type)
- ☐ Soil Classification _____ (Type)
- ☐ Slope 1-1/2-1
- ☐ Trench Shoring Box
- ☐ Special Engineered Design

AND

- ☐ Correct Shore/Shield
- ☐ Manufacturer's Tabulated Data
- ☐ Protective System Inspection
- ☐ Correct Slope _____

ENCUMBRANCES

- ☐ Above Ground
- ☐ Below Ground
- ☐ Surcharge Loads

General

- ☐ Hazcom
- ☐ Ladder/Ramp
- ☐ Hazardous Atmosphere
- ☐ Spoil Material Placement
- ☐ Water Accumulation
- ☐ Utility Locations
- ☐ Other: _____

NOTES

129

APPENDIX 2

Page 2 of 3

PART 2**INSPECTION REQUIREMENTS**

1. HAS the daily inspection of the excavation site been made by the Competent Person? ☐ Yes ☐ No ☐ NA
2. ARE hard hats being worn by all personnel at all times when on the excavation site? ☐ Yes ☐ No ☐ NA
3. ARE personal protective equipment (eye shields, toe shields, etc.) being used? ☐ Yes ☐ No ☐ NA
4. ARE employees who are exposed to vehicular traffic wearing warning vests? ☐ Yes ☐ No ☐ NA
5. ARE employees being kept out from under suspended loads? ☐ Yes ☐ No ☐ NA
6. IF underground utility installations are located, HAVE they been protected, braced, or removed to safeguard employees? ☐ Yes ☐ No ☐ NA
7. HAVE all surface encumbrances been removed? ☐ Yes ☐ No ☐ NA
8. In excavations into which employees are required to enter, HAVE excavated or other materials been effectively stored and retained at least 2 ft or more from the edge of the excavation? ☐ Yes ☐ No ☐ NA
9. DO trenches 4 ft deep or more HAVE adequate means of exit, such as ladders or steps located where no more than 25 ft of travel is required? ☐ Yes ☐ No ☐ NA
10. HAS a harness and lifeline been provided whenever an employee is required to enter a confined footing excavation? ☐ Yes ☐ No ☐ NA
11. HAVE steps been taken to protect employees from loose rock and hazards of falling rock? ☐ Yes ☐ No ☐ NA
12. DO the walls and faces of trenches 4 ft or deeper and all excavations in which employees are exposed to danger from moving ground or a cave-in HAVE a protection system, i.e., shoring, sloping or some other equivalent means? ☐ Yes ☐ No ☐ NA
13. IS there any evidence of a possible cave-in or slide? ☐ Yes ☐ No ☐ NA
If Yes, all work in the excavation MUST cease until the necessary precautions have been taken to safeguard the employees.
14. HAVE guardrails been provided when employees are required to cross a walkway at an excavation site? ☐ Yes ☐ No ☐ NA
15. If excavation is remote, such as a well, pit, or shaft, HAVE physical barriers been provided? ☐ Yes ☐ No ☐ NA

EXCAVATIONS AND TRENCHING

10/29/93

1-B37-HSP-1208
REVISION 0
PAGE 27

APPENDIX 2
Page 3 of 3

- | | | | |
|---|------------------------------|-----------------------------|-----------------------------|
| 16. HAVE structural ramps used solely by employees been designed by a competent person? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 17. DO the structural ramps HAVE appropriate means provided to prevent slipping and ARE the runways uniform in thickness? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 18. HAS a barricade, stop log, or hand signal been provided when equipment is required close to the excavation? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 19. ARE sidewalks, pavements, etc. protected from undercut? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 20. HAVE adjoining buildings, walls, etc. been braced or otherwise supported? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 21. HAS the air in or around the excavation site been tested to make sure an oxygen deficiency or hazardous atmosphere does not exist? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 22. If hazardous atmosphere does exist, HAS proper Personal Protective Equipment been provided? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 23. IS water accumulation a problem?
If YES, ARE employees in the excavation site protected and equipment monitored by a competent person? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 24. DOES the excavation interfere the natural drainage?
If YES, HAS suitable means been provided to divert the water? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

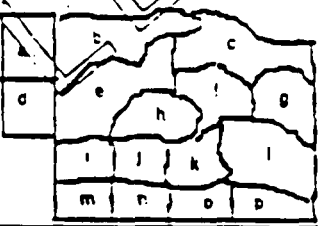
OTHER CONDITIONS OR COMMENTS

10/29/93

APPENDIX 3

Page 1 of 1

LAND USE REQUEST

LAND USE REQUEST																											
SOW or CA Title:		Authorization No.:																									
Work Manager:		WC No.:																									
Group:		Phone No.:																									
Check the Boxes That Apply: <div style="display: flex; flex-wrap: wrap; margin-top: 5px;"> <div style="width: 50%;"><input type="checkbox"/> IAG Driven</div> <div style="width: 50%;"><input type="checkbox"/> Routine Program</div> <div style="width: 50%;"><input type="checkbox"/> Regulatory Driven</div> <div style="width: 50%;"><input type="checkbox"/> Site Investigation</div> <div style="width: 50%;"><input type="checkbox"/> Other</div> <div style="width: 50%;"><input type="checkbox"/> RCRA</div> <div style="width: 50%;"><input type="checkbox"/> CERCLA</div> </div>																											
Job Description/Objectives:																											
Location Description (Describe below and indicate on Locator Map to Right). Also Attach Detailed Plan and Location Map: <div style="text-align: right; margin-top: 10px;">  </div>																											
Emergency Contacts (Name and Number): EG&G Project Manager: Subcontractor Manager:																											
Plant Support Required? If yes, List/Describe It. No, List Contractor Support To Be Provided: <input type="checkbox"/> Yes <input type="checkbox"/> No																											
Duration of Project (Include Start/End Dates):																											
Is This Follow-up To Existing Work? <input type="checkbox"/> Yes <input type="checkbox"/> No Contract No. _____ Title _____ Manager _____ Describe: _____																											
Note: Upon Contract Award, Submit List of Subcontract Personnel needing Access to Buffer Zone																											
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4" style="text-align: left; padding: 2px;">AUTHORIZATION</th> </tr> </thead> <tbody> <tr> <td style="width: 5%; padding: 2px;"><input type="checkbox"/></td> <td style="width: 85%; padding: 2px;">RECOMMEND REFERRAL TO RFP LONG RANGE PLANNING COMMITTEE</td> <td style="width: 5%; padding: 2px;"></td> <td style="width: 5%; padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;"><input type="checkbox"/></td> <td style="padding: 2px;">PERMISSION DENIED</td> <td style="padding: 2px;"></td> <td style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;"><input type="checkbox"/></td> <td style="padding: 2px;">REQUEST MORE INFORMATION AS SPECIFIED</td> <td style="padding: 2px;"></td> <td style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;"><input type="checkbox"/></td> <td style="padding: 2px;">PERMISSION GRANTED</td> <td style="padding: 2px;">Signature _____</td> <td style="padding: 2px;">Date _____</td> </tr> <tr> <td colspan="2" style="padding: 2px;"></td> <td style="padding: 2px;">Contract No. _____</td> <td style="padding: 2px;"></td> </tr> </tbody> </table>				AUTHORIZATION				<input type="checkbox"/>	RECOMMEND REFERRAL TO RFP LONG RANGE PLANNING COMMITTEE			<input type="checkbox"/>	PERMISSION DENIED			<input type="checkbox"/>	REQUEST MORE INFORMATION AS SPECIFIED			<input type="checkbox"/>	PERMISSION GRANTED	Signature _____	Date _____			Contract No. _____	
AUTHORIZATION																											
<input type="checkbox"/>	RECOMMEND REFERRAL TO RFP LONG RANGE PLANNING COMMITTEE																										
<input type="checkbox"/>	PERMISSION DENIED																										
<input type="checkbox"/>	REQUEST MORE INFORMATION AS SPECIFIED																										
<input type="checkbox"/>	PERMISSION GRANTED	Signature _____	Date _____																								
		Contract No. _____																									

RF-46427

Revised 01/02/92

**ROCKY FLATS PLANT
SOIL REMEDIATION IM/IRA**

SOIL PREPARATION, SEEDING, AND MULCHING

From Watershed Management Plan for Rocky Flats - April 1993

5.0 VEGETATION STABILIZATION PROGRAM

5.1 PERSPECTIVE

The natural plant communities which existed at Rocky Flats historically have been altered by disturbances, grazing, invasion by weeds, and past revegetation efforts. In certain areas, plant cover is currently sparse; other areas require weed control or may be disturbed by construction activities which will reduce the plant cover in the future. Vegetation stabilization is needed where plant cover is sparse to prevent erosion and maintain natural vegetation.

No formal plan has existed at RFP for vegetation stabilization. The Vegetation Stabilization Program (VSP) is a detailed program for such measures for the entire site.

5.2 PURPOSE

The purpose of the VSP is to maintain and encourage native vegetation to prevent soil erosion, decrease the abundance of weeds and maintain the diversity of plant and wildlife habitat at RFP. This will be accomplished by seeding and planting native vegetation which exists at the plant site. Establishment and maintenance of native vegetative cover can reduce weed infestation through vegetative competition.

A goal of this program is to establish long-term plant diversity and site stabilization through revegetation. In the short-term, the goal is to provide stabilization to prevent erosion.

5.3 SCOPE/IMPLEMENTATION

The VSP shall be utilized for any project, program, or maintenance activity affecting any watershed at RFP such as:

- Weed control actions (Section 4.0) which result in exposure of bare soils,
- Erosion control actions (Section 6.0),
- Construction or maintenance activities which cause ground disturbance, or
- Disturbed areas with sparse plant cover.

The VSP will be implemented consistent with the process outlined in Section 2.5.

5.4 VEGETATION STABILIZATION GUIDELINES

- 5.4.1 Activities on the plant site that destroy existing plant cover or otherwise expose bare soil shall be revegetated as quickly as possible.
- 5.4.2 Revegetation activities will be conducted concurrently with disturbance activities to the extent possible;
- 5.4.3 Long-term stabilization is best achieved through a vigorous, continuous, and diverse plant cover;
- 5.4.4 Mulch or other erosion control measures shall be utilized to foster plant establishment and control erosion during the period of vegetation establishment.
- 5.4.5 Vegetation stabilization activities shall not be conducted in the sensitive habitat areas shown in Figure 3.7, or in established reference sites or monitoring areas used as part of the WMP or other ongoing studies.
- 5.4.6 Vegetation stabilization activities which require soil disturbance will not be conducted in IHSSs, or areas of soil plutonium concentrations of concern.

5.4.7 Vegetation stabilization activities should follow the sequential steps outlined below, as appropriate for the conditions at the location on the plant site. The steps may be modified to account for specific conditions (Section 2.3).

- Seed/planting bed preparation,
- Topsoiling,
- Soil amendments/fertilizer,
- Seeding/planting,
- Mulching/erosion control, and
- Monitoring and other follow-up measures.

5.4.8 Seed/Planting Bed Preparation

- 5.4.8.a The top 4-6 inches of the surface shall be tilled to an even and loose seed bed a minimum of 4-6 inches deep, free of clods in excess of approximately four inches in diameter.
- 5.4.8.b The surface shall then be brought to the desired grade as shown on grading plans or otherwise specified. This grade should be below the finished grade to account for topsoil placement.
- 5.4.8.c Grading equipment used should be selected to avoid soil compaction to the extent possible.

5.4.9 Topsoiling

- 5.4.9.a Topsoil shall be obtained from off-site sources because of the desire to not disturb additional areas on site. However, suitable topsoil stockpiled from another project may be used as long as its use does not cause additional disturbance.
- 5.4.9.b Topsoil shall consist of loose, friable, loam soil which is free of subsoil, heavy clay, refuse, stumps, rocks, brush, weeds, toxic substances, or other materials that would be detrimental to plant growth.

- 5.4.9.c Topsoil should have a minimum available moisture capacity of seven percent (by weight); organic matter content should be a minimum of one percent.
- 5.4.9.d Topsoil should be adequate to cover the site to be revegetated to a minimum depth of three inches over the subsoil material.
- 5.4.9.e Topsoil shall be applied evenly over the area using equipment to avoid compaction, and to a depth replicating the original contours or as otherwise specified.
- 5.4.9.f Topsoil placement shall be accomplished as quickly as possible on a disturbed site.
- 5.4.9.g All excess imported topsoil shall be removed from the site, stockpiled, and planted with a cover crop (Table 5.5), and/or other erosion control materials used (Section 6.0).

5.4.10 Soil Amendments/Fertilizers

- 5.4.10.a Testing should be conducted to determine fertilizer requirements.
- 5.4.10.b Fertilizer shall consist of a standard commercial form and be incorporated into the top 4-6 inches of topsoil using equipment to avoid compaction at a rate no greater than specified by the results of the fertilizer test.
- 5.4.10.c Application of fertilizer high in nitrogen to areas with sparse, desirable plant cover will be avoided, unless an organic mulch (e.g., straw) is applied to the area.
- 5.4.10.d Commercial fertilizers shall conform to all applicable state fertilizer laws and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis.
- 5.4.10.e Peat moss or composted manure from commercial sources may be used to amend topsoil to meet the specifications in 5.4.8. Any such soil amendments will be tilled

into the topsoil either manually or mechanically to achieve uniformity using equipment which avoids compaction.

5.4.11 Seeding

- 5.4.11.a Seed shall be furnished in bags or containers clearly labeled to show the name and address of the supplier, seed name or mix, lot number, net weight, origin, the percentage of weed seed content, guaranteed percentage of purity, germination pounds of pure live seed (PLS) of each seed species, and total pounds of PLS in the container.
- 5.4.11.b The seed mixtures in Tables 5.1-5.4 will be used for the appropriate portions of the site, unless changes are approved in advance from EPM/SWD. The "Rapid Establishment" mix will be used for bare soil or areas with sparse cover. The "moderate establishment" mix will be used where there is some desirable plant cover, or to prevent competition with existing native plants.
- 5.4.11.c Grass seeding will be conducted in the fall (October 15 until consistent ground freeze) or early spring when the soil temperature reaches approximately 50 degrees (Spring thaw to May 1). Spot seeding around buildings where water is available for irrigation for areas up to 10 square feet will be conducted throughout the summer season.
- 5.4.11.d The seed mix in Table 5.5 will be used as a temporary cover crop for topsoil stockpiles or other areas which will be left for greater than one month.
- 5.4.11.e Slopes 2:1 and flatter shall be seeded with a no-till drill, or mechanical power drawn drill, followed by packer-wheels or drag-chains. Mechanical power drills shall have depth bands set to the appropriate depth for the seed being sown, not to exceed a planting depth of at least one-fourth inch, and shall be set to space rows not more than seven inches apart. Seed that is extremely small shall be sowed from a separate hopper adjusted to the proper rate of application.

TABLE 5.1
SEED MIXTURE FOR WEST PART OF PLANT -
MODERATE ESTABLISHMENT RATE¹

Species-Variety	Seeding Rate (lbs/ac PLS) ²	Seeding Vigor ³	Soil Texture ⁴	Purity (%)	Germi- nation (%)
Western wheatgrass-ARRIBA (<i>Agropyron smithii</i>)	1.6	2	L,C	85	60
Beardless wheatgrass-WHITMAR (<i>Agropyron inermiti</i>)	1.2	2	L,C	90	85
Big bluestem-KAW (<i>Andropogon gerardii</i>)	1.6	3	S,L	85	75
Blue grama-LOVINGTON (<i>Bouteloua gracilis</i>)	0.5	2	S,L,C	90	85
Buffalo grass-SHARP's improved (<i>Buchloe dactyloides</i>)	1.6	2	L,C	90	85
Total	6.5				

¹ To be used in areas with some plant cover or where competition with existing plants is undesirable.

² For rangeland drill. Rates should be doubled for broadcast seeding. Rates may be increased 1.5 times if area is actively eroding.

³ From: USDA, Soil Conservation Service, June 1982, Technical Guide, Section IV #342:

1 = low,

2 = fair,

3 = average,

4 = good, and

5 = excellent.

⁴ L = loamy soils; C = clayey soils, and S = sandy soils.

TABLE 5.2
SEED MIXTURE FOR WEST PART OF PLANT -
RAPID ESTABLISHMENT RATE¹

Species-Variety	Seeding Rate (lbs/ac PLS) ²	Seeding Vigor ³	Soil Texture ⁴	Purity (%)	Germi- nation (%)
Big bluestem-KAW (<i>Andropogon gerardii</i>)	1.1	3	S,L	85	75
Sideoats grama-VAUGHN (<i>Bouteloua curtipendula</i>)	0.9	5	S,L,C	varies	varies
Switchgrass-NEBRASKA 28 or GRENVILLE (<i>Panicum virgatum</i>)	3.8	4	S,L	varies	varies
Little bluestem-CAMPER or PASTURA (<i>Schyzachyrium scoparium</i>)	0.5	4	S,L	85	75
Green needlegrass (<i>Stipa viridula</i>)	0.8	4	S,L	varies	varies
Thickspike wheatgrass CRITANA (<i>Agropyron dasystachyum</i>)	0.8	4	S,L	85	85
Western wheatgrass-ARRIBA (<i>Agropyron smithii</i>)	1.6	2	L,C	85	60
Total	9.5				

¹ To be used on bare soil or in areas with sparse plant cover.

² For rangeland drill. Rates should be doubled for broadcast seeding. Rates may be increased 1.5 times if area is actively eroding.

³ From: USDA, Soil Conservation Service, June 1982, Technical Guide, Section IV #342:

1 = low,

2 = fair,

3 = average,

4 = good, and

5 = excellent.

⁴ L = loamy soils; C = clayey soils, and S = sandy soils.

TABLE 5.3
SEED MIXTURE FOR EAST PART OF PLANT -
MODERATE ESTABLISHMENT RATE¹

Species-Variety	Seeding Rate (lbs/ac PLS) ²	Seeding Vigor ³	Soil Texture ⁴	Purity (%)	Germina- tion (%)
Western wheatgrass- ARRIBA (<i>Agropyron smithii</i>)	2.0	2	L,C	85	60
Beardless wheatgrass- WHITMAR (<i>Agropyron inermiti</i>)	1.2	2	L,C	90	85
Blue grama- LOVINGTON (<i>Bouteloua gracilis</i>)	0.5	2	S,L,C	90	85
Buffalo grass- SHARP's improved (<i>Buchloe dactyloides</i>)	1.6	2	L,C	90	85
Indian ricegrass- PALOMA (<i>Oryzopsis hymenoides</i>)	1.2	2	S,L	Variable	Variable
Total	6.5				

¹ To be used in areas with some plant cover or where competition with existing plants is undesirable.

² For rangeland drill. Rates should be doubled for broadcast seeding. Rates may be increased 1.5 times if area is actively eroding.

³ From: USDA, Soil Conservation Service, June 1982, Technical Guide, Section IV #342:

- 1 = low,
- 2 = fair,
- 3 = average,
- 4 = good, and
- 5 = excellent.

⁴ L = loamy soils; C = clayey soils, and S = sandy soils.

141

TABLE 5.4
SEED MIXTURE FOR EAST PART OF PLANT -
RAPID ESTABLISHMENT RATE¹

Species-Variety	Seeding Rate (lbs/ac PLS) ²	Seeding Vigor ³	Soil Texture ⁴	Purity (%)	Germi- nation (%)
Slender wheatgrass-PRIMAR, PYROR (<i>Agropyron trachycaulum</i>)	2.8	4	L,C	85	75
Sideoats grama-VAUGHN (<i>Bouteloua curtipendula</i>)	1.6	5	S,L,C	Variable	Vari- able
Green needlegrass (<i>Stipa viridula</i>)	2.0	4	S,L	Variable	Vari- able
Total	6.5				

¹ To be used on bare soil or areas with sparse plant cover.

² For rangeland drill. Rates should be doubled for broadcast seeding. Rates may be increased 1.5 times if area is actively eroding.

³ From: USDA, Soil Conservation Service, June 1982, Technical Guide, Section IV #342:

1 = low,

2 = fair,

3 = average,

4 = good, and

5 = excellent.

⁴ L = loamy soils; C = clayey soils, and S = sandy soils.

TABLE 5.5
RECOMMENDED SEEDING FOR TEMPORARY VEGETATION COVER¹

Species ²	Seeding Rate (lbs/ac PLS) ³	Notes/Applicability ⁴
Annual ryegrass (<i>Lolium multiflorum</i>)	15	Cool season annual for quick temporary cover. Easy to establish.
Cereal rye (<i>Secale cereale</i>)	30	Cool season annual for quick temporary cover. Easy to establish.
Spring Barley	15	Easy to establish annual for quick temporary cover.
TOTAL	60	

¹ To be used on stockpiles or exposed areas which will be left for more than one month.

² Species variety is not critical. All plants can be seeded throughout the year.

³ Rates are for drilling, double for broadcasting. Recommend 40 lbs. of N and 40 lbs. of P₂O₅ at time of seeding.

⁴ Wait two-three weeks after use of glyphosate herbicides before seeding. Cover can be plowed under in early spring for "green manure."

- 5.4.11.f Slopes 2:1 or steeper may be seeded by hydraulic seeding equipment or by hand broadcasting. Seed, fertilizer and mulch may be applied in a single application, after topsoil application, followed by a second application of mulch.
- 5.4.11.g Smaller disturbed sites or areas not accessible to machine methods may be seeded by broadcasting or hand method. All seed sown by broadcast-type seeders or by hand shall be raked in or covered with soil to a maximum depth of 1/4 inch.
- 5.4.11.h Seeding will follow as closely behind the tilling of fertilizer and/or soil amendments as possible.

5.4.12 Containerized Plants

- 5.4.12.a Containerized ("potted") plants or tube stock will be in a healthy condition with normal, well-developed branch and root systems, and shall conform to the current requirements of the "American Standard of Nursery Stock." All nursery stock will be accompanied by certificates of inspection of plant materials that are required by federal, state or local laws.
- 5.4.12.b All plants shall be free of diseases and insect pests. Each species will be identified by means of a grower's label affixed to the plant. The grower's label will give the data necessary to indicate conformance to planting specifications. Containerized plants purchased for revegetation at RFP shall be grown in a climate and at an elevation similar to RFP.
- 5.4.12.c The containerized plants used shall be those listed in Table 5.6, unless changes are approved in advance from EPM/SWD and EPM/END.
- 5.4.12.d Planting of tube stock plants and small potted plants shall be conducted in a similar fashion as US Forest Service seedling plantings. A hole shall be dug in the soil approximately the depth of the tube, the plant placed in the hole, the soil backfilled and moderately compacted by hand.

244

TABLE 5.6
SHRUBS FOR VEGETATION STABILIZATION AT ROCKY FLATS

Species	Applicability	Form	Notes
Four wing salt brush (<i>Atriplex canescens</i>)	Good on saline, alkaline sites. Dry to moderately dry sites.	Seed ¹ or potted	Fair tolerance to flooding. ½ lb/acre PLS.
Winter fat - native or Hatch (<i>Ceratoides lanata</i>)	Dry to moderately dry sites. Poor tolerance to flooding.	Seed ¹ or potted	½ lb/acre PLS. Likes CaCO ₃ .
Sagebrush (<i>Artemisia tridentata</i>)	Dry loam to clay soils. Very poor tolerance to flooding.	Seed ¹ or potted	Plant as open stand, or broadcast seed @ 2 oz./acre in fall and drag lightly.
Cinquefoil (<i>Pentaphylloides floribunda</i>)	Wet site. Loam to clay soils.	Tubling or Potted	Plant open stand in patches away from roses or willows.
Wild rose (<i>Rosa woodsii</i>)	Mesic site. Sandy loam to clay loam soils. Streambank.	Tubling or Potted	Plant as open stand in patches.
Willow (<i>Salix spp.</i>)	Moist to wet sites. Sandy loam to clay loam soils. Streambank.	Cuttings or Potted	Very aggressive. Easy to establish. Shades other species.

¹ Seed success more variable.

- 5.4.12.e Planting of larger shrubs (approximately two feet in height or larger) shall be done in accordance with good horticultural practices. Planting pits shall be dug two inches shallower than the height of the root ball. The pit will be backfilled with peat moss mixed with soil to a depth of approximately 1½ inches, the plant will be placed in the pit and the peat moss/soil mix dressed to approximately one-half inch above the root ball. The plant will be watered and additional peat added and lightly compressed. The excess soil from the pit will be used to construct a water retention berm around the plant and the area watered again. A one-inch layer of mulch may be added within the bermed area.
- 5.4.12.f Shrub seeding shall be conducted as specified in Table 5.6, or otherwise approved by EPM/SWD.
- 5.4.12.g All cuttings (e.g., willows) shall be at least 16 inches long and collected from dormant shrubs in a pre-budded condition. The cuttings will be inserted vertically in a hole dug below the local groundwater level or irrigation provided to encourage rooting and growth. All cuttings will be planted in the spring within one week of collection, and cuttings properly stored in a cool, moist condition prior to planting to prevent desiccation.
- 5.4.13 Mulching/Erosion Control
- 5.4.13.a Soil mulching will be conducted to enhance soil moisture content and seed germination, and reduce soil erosion. Mulching requirements will be dependent on aspect, slope degree, and site disturbance.
- 5.4.13.b Straw or hay mulch shall be certified weed free. Straw or hay mulches will be uniformly applied at a minimum rate of two tons per acre. The mulch shall be crimped in place with a crimper, or stabilized by the use of approved netting staked at appropriate intervals.

5.4.13.c On slopes steeper than 2:1 or other designated areas, burlap or blanketing materials such as Miramat or Excelsior Erosion Control Blankets shall be anchored and secured to the soil surface after seeding.

5.4.13.d On slopes steeper than 2:1 or other designated areas, hydraulic wood cellulose fiber mulch may be applied at a minimum rate of 1,500 pounds per acre. The hydraulic mulch shall be uniformly sprayed over the designated area and shall not contain any substance which may inhibit germination or growth of grass seed. The hydraulic mulch will be dyed an appropriate color to allow visual metering of its application. An approved tackifier may be used to stabilize the fiber mulch.

5.4.14 Protection

5.4.14.a Adequate site protection will be provided to prevent adverse disturbance of areas receiving vegetation stabilization activities. The need for protection will be determined by EPM/SWD prior to implementation.

5.4.14.b Protection may include the use of:

- Fencing,
- Posting, or
- Blockades.

5.4.14.c Protection measures will be reviewed by and coordinated with the Environmental Restoration Land Use Coordinator.

5.4.15 Monitoring/Follow-up Measures

5.4.15.a All vegetation stabilization activities conducted under Section 5.0 will be monitored following completion to determine their success and the need for follow-up measures.

5.4.15.b Monitoring shall consist of visual inspection to document:

- Germination/planting success,
- Effectiveness of mulch or other erosion control measures,

- Degree of invasion by weeds, and
- Overall site condition and need for follow-up measures.

5.4.15.c Monitoring shall be conducted by qualified personnel at the following intervals after completion of the work or as otherwise necessary for the site:

- Approximately two weeks after planting/seeding,
- Approximately one month,
- Approximately three months, and
- Approximately six months.

5.4.15.d In addition to the monitoring schedule in 5.4.8.c, it is desirable to inspect each site the following growing season and periodically thereafter to assess long-term viability.

5.4.15.e Follow-up measures will be implemented when it is determined upon site inspection that the desired revegetation results are not being achieved. Deficiencies at a site may include:

- Low germination of seeded plants,
- Low survival of containerized plants,
- Excessive erosion as evidenced by rills, sediment deposits, or other evidence, and
- Invasion of the site by weeds.

5.4.15.f Measures will be implemented to correct deficiencies and shall follow the guidelines previously specified in this section and elsewhere in the WMP for the activity, unless prior approval is obtained. Follow-up actions may include:

- Reseeding,
- Replanting,
- Application of new or additional mulch,
- Application of new erosion controls,
- Watering, and
- Weed control actions.

5.4.15.g Prior to conducting any follow-up measures, adequate documentation of need will be obtained and a plan developed with EPM/SWD and EPM/END.

APPENDIX B: SAMPLING AND ANALYSIS REQUIREMENTS

SAMPLING & ANALYSIS REQUIREMENTS

This appendix presents the sampling and analysis requirements for the Soil Remediation IM/IRA. Data are needed to evaluate the suitability of specific IHSSs for inclusion in the Soil Remediation IM/IRA (existing data) and to confirm the effectiveness of the implemented action (confirmatory data). This appendix presents the criteria for sufficiency and validity of existing data, as well as a procedure to collect statistically significant confirmatory data.

B.1 EXISTING DATA

As discussed in the main text of this Decision Document, an IHSS will only be considered for possible early action under this IM/IRA process if there are sufficient, validated environmental data to understand the nature and extent of contamination, the current health and environmental risks and the potential for contaminant migration. The criteria for data sufficiency and validity are presented below.

B.1.1 Data Sufficiency

For removal and capping actions, there must be sufficient data to establish the presence of contamination, as well as the vertical and horizontal extent of contamination. Assuming that the available data represent random samples, the number of samples needed to establish the presence of contamination can be calculated based on the binomial probability distribution (the binomial condition is appropriate because the determined concentration is either equal to or above the PRG, or it is not). The binomial probability distribution is expressed mathematically as follows.

$$p(y) = \{n!/[y!(n-y)!]\} \times p^y \times q^{n-y}$$

in which,

$p(y)$ = the probability that an event will occur in the samples of a population,

n = the number of samples,

y = the number of occurrences of the event in the samples,

p = the ratio of occurrences of the event in the population, and

q = the ratio of non-occurrences of the event in the population ($q = 1 - p$).

If y is set to zero (i.e., no samples are collected that are equal to or greater than the PRG), the expression reduces to the following.

$$p(y) = (1-p)^n$$

If 25 percent of the site is actually contaminated, there is a 10 percent chance that eight samples can be collected without finding one that is equal to or exceeds the PRG. Thus, nine samples must be available that are less than the PRG before it can be concluded that the site is not contaminated (with 90 percent certainty).

In addition, for purposes of determining the nature and extent of contamination, each IHSS will be divided conceptually into two strata (domains): the surface and the subsurface. Nine samples must be available from each stratum. Surface samples must have been collected from the depth range of the surface to 0.5 feet below the surface (or less). Subsurface samples must have been collected from the depth range of 0.5 feet to 6 feet below the surface. Composite samples of subsurface materials must not represent more than two feet of the subsurface. The samples must have been analyzed for the contaminants of concern.

Other levels of certainty can be selected with corresponding sampling requirements; however, 90 percent certainty is believed appropriate for this evaluation. If the site is determined to be contaminated (at least one sample of the nine equals or exceeds the PRG), then the IHSS is a candidate for the Soil Remediation IM/IRA. If nine samples are not available or there are nine samples but none exceeds the PRG, the IHSS is not a candidate for early action. If the site is not a candidate for early action, it may be a candidate for NFA (see criteria above) or it may require additional characterization under the RI/FS process.

B.1.2 Data Validity

For purposes of evaluating the suitability of specific IHSSs for excavation or capping actions under the Soil Remediation IM/IRA, all available data will be utilized unless the data have been

rejected as unusable in a data quality review. In some cases, the decision will therefore be based on data of questionable precision or accuracy; however, this is believed appropriate because there is no environmental risk associated with an incorrect decision. If the data indicate that contamination is present when it actually is not, the cost of the excavation or capping action will have been wasted but no environmental harm will have been done. If the data indicate that the site is not contaminated when it actually is, the site will be rejected as a candidate for an excavation or capping action under the Soil Remediation IM/IRA and it will be handled under the standard RI/FS program.

B.2 CONFIRMATORY DATA

As part of the implementation of the excavation and capping alternatives, confirmatory samples will be collected to direct the extent of the soil removal and to document the effectiveness of the action. Data quality objectives, field tests and laboratory analyses for confirmatory data are discussed below.

B.2.1 Data Quality Objectives

The Data Quality Objectives (DQOs) process as described in EPA (1993) has been used to develop DQOs for this program. The DQO process is based on the scientific method and consists of seven steps intended to generate data of known quality which are appropriate for the intended use. The seven steps are discussed below.

State the Problem

In brief, there are numerous IHSSs with small volumes of contaminated soil at the Rocky Flats Plant. The contamination consists of radioactive materials, organics, metallics and other compounds (either singly or as mixtures). The processes that have developed over the years for characterizing and remediating environmental problems at the plant are costly and slow. In an effort to expedite site clean-up, an IM/IRA approach that combines like problems in a single medium (specifically, soil contamination for which the risk can be appreciably reduced by excavating a relatively small volume or by capping the soil). Many of these sites have already

been sufficiently investigated that the site specific characteristics are known, e.g., contaminants of concern, areal and vertical extent of contamination, geology, hydrogeology, and exposure pathways.

Identify the Decision

Data will be collected during implementation of the Soil Remediation IM/IRA to provide input to several decisions, as follows.

1. Are the limits of contamination the same as the IHSS boundary (can smaller areas be excavated or capped)?
2. Has the contaminated soil been removed or covered by the excavation or capping process (are the clean-up goals met)?
3. If the clean-up goals are not met in the base of the excavation, what are the residual contaminant levels which must be addressed in the final action for the IHSS under the RI/FS process?

Identify Inputs to the Decision

In order to make these decisions, data regarding contaminant levels must be collected prior to the start of excavation or capping, as the excavation is made (to guide the extent of excavation) and when the excavation is complete. It is envisioned that some of the excavations will result in complete removal of the contaminants at depths less than the maximum excavation depth under the Soil Remediation IM/IRA (four feet). In addition, it is expected that other excavations will reach the maximum excavation depth without removing all of the contaminants. ARARs and PRGs are discussed in the main text of this document.

Define the Study Boundaries

The spatial boundaries of each IHSS have been defined based on reviews of historical operating records, aerial photographs and other information. The boundaries for excavation and capping will be verified using field techniques prior to the commencement of the action, if appropriate. There are no temporal or physical constraints to sample collection.

Develop a Decision Rule

Rules for the decisions to be made during the Soil Remediation IM/IRA are as follows.

1. Are the limits of contamination the same as the IHSS boundary (can smaller areas be excavated or capped)? This can be re-stated as:

if portions of the IHSS have contaminant concentrations below the PRGs, then the area to be remediated will be less than the entire IHSS.

The null hypothesis is that the area to be remediated encompasses the entire IHSS.

2. Has the contaminated soil been removed by the excavation process (are the clean-up goals met)? This can be re-stated as:

if sampling data collected as the excavation is made indicate that contaminant levels are less than the PRGs, then excavation will be halted.

The null hypothesis is that contamination exists in the excavation.

3. If the clean-up goals are not met in the base of the excavation, what are the residual contaminant levels which must be addressed in the final action for the IHSS under the RI/FS process? This can be re-stated as:

if contaminant levels exceed the PRGs when the maximum excavation depth is reached, then excavation will be halted and the remaining contaminants will be left for resolution under the final action.

The null hypothesis is that contamination exists in the excavation.

Specify Limits on Decision Errors

For the first two decisions, a ten percent chance of rejecting the null hypothesis is believed appropriate. If a smaller area is capped or excavated than really should be or if the excavation is halted when it really should continue, no environmental harm is done and the areas or contaminants not controlled will be dealt with under the standard RI/FS process.

For the last decision, a more restrictive certainty of five percent is believed appropriate. In this case, the goal is to be fairly certain that contamination is detected and quantified if present after

completion of the excavation. The presence of residual levels must be known so that the need for a final action can be evaluated and a design developed, if needed.

Optimize the Design for Obtaining Data

The optimized design is described in the following sections.

B.2.2 Field Tests

Before commencement of excavation and capping actions, an initial site screening for radioactivity and/or hydrocarbon content (as appropriate) will be performed to better define the extent of the action. During the excavation process, field tests will be performed for every foot of excavation. Measurements will be made at the nodes of a triangular grid with a grid spacing of ten feet. Assuming a square excavation that is four feet deep and involves 500 cubic yards of soil, the excavation will have side lengths of approximately 60 feet. Thus, approximately 36 points will be sampled in the excavation. Following Gilbert (1987), this scheme has a 90 percent chance of finding a circular area of contamination that has a radius of five feet. If the IHSS is significantly larger than 360 square feet, the grid spacing will be adjusted such that approximately 36 points are sampled.

The triangular grid will be laid out beginning with a randomly selected location. A random integer coordinate (X, Y) will be selected from the range of coordinates falling within the IHSS. Gridlines will then be constructed parallel to the X axis and on 10 ft. centers, using the randomly selected location as the basis. Grid intersections that lie more than one grid spacing outside the excavation or IHSS (as appropriate) will be ignored. The sampling grid will be shown in the Implementation Document.

The following field instrumentation will be used for field screening and to guide the excavation process.

- Gamma and low energy X-ray radiation will be evaluated using a Bicorn FIDLER (Field Instrument for the Detection of Low-Energy Radiation) following procedures described in EMRG 6.6 of the Environmental Management Radiological Guidelines.

- Alpha and beta/gamma surveys will be performed using Ludlum Models 12-1A and 31 (respectively) following procedures specified in EMRG 3.1.
- Hydrocarbon content will be determined based on headspace analyses of bagged samples collected from the grid locations described above. Samples will be collected using the spade and scoop method described in SOP GT.08. Measurements will be made using either a photoionization detector or a flame ionization detector (as appropriate for the contaminant of concern) following SOP GT.9.
- Other field tests may also be performed when appropriate, such as ion specific electrode measurements or field test kits for specific compounds.

B.2.3 Laboratory Analyses

When the field screening tests indicate that sufficient soil has been excavated, confirmatory samples will be collected for laboratory analysis. Samples will be collected using the spade and scoop method described in SOP GT.08. The samples will be containerized, preserved, handled and shipped as described in SOP FO.13. Samples will be analyzed by an off site, independent laboratory, schedule permitting. If analytical delays are anticipated, the majority of the analyses will be performed on site, with ten percent of the samples analyzed in duplicate by an off site, independent laboratory. Analyses will be performed following methods described in SW-846 (EPA, 1986) for organics and metals. EPA method 520-84-006 will be used for analysis of plutonium-239, plutonium-240 and americium-241. EPA method 091.1 will be used for analysis of cesium-137. Other radionuclides will be analyzed following methods described in EPA (1979). Detection limits will equal or be less than the PRGs.

Using the binomial probability distribution as discussed earlier, nineteen samples of the soil in the base of each excavation will be collected. There is only a five percent chance that nineteen clean samples can be collected from an excavation that is 15 percent contaminated. Sampling locations will be selected at random from the points created as part of the field sampling grid. Samples will be collected from the first six inches of the material exposed in the excavation and will be analyzed for the contaminants of concern. All sample locations and elevations will be surveyed for documentation purposes.

B.2.4 Data Validation

All confirmatory data will be validated (and the validation process will be documented) so that the results can be used to evaluate the need for and to develop an appropriate design of a final action. The data validation will include both field and laboratory data. Organic and inorganic data will be validated following EPA (1989 and 1991). Radiochemical data will be validated following EG&G (1992).

REFERENCES

EG&G, 1992, General Radiochemistry and Routine Analytical Services Protocol (GRRASP), July.

EPA, 1986, Test Methods for Evaluating Solid Waste, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Third Edition (with periodic updates), November.

EPA, 1989, Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses, October.

EPA, 1991, National Functional Guidelines for Organic Data Review, June.

EPA, 1993, Data Quality Objectives Process for Superfund, Interim Final Guidance, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, 9355.9-01, EPA 540-R-93-071, September.

Gilbert, R.O., 1987, Statistical Methods for Environmental Pollution Monitoring, Van Nostrand Reinhold Company, New York.

APPENDIX C:
FEDERAL AND STATE APPLICABLE OR RELEVANT
AND APPROPRIATE REQUIREMENTS
(ARARs)

**ROCKY FLATS PLANT (RFP) SOIL REMEDIATION IM/IRA
FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
AND TO-BE-CONSIDERED GUIDANCE (TBCs)**

Standard, Requirement Criteria, or Limitation	Citation	Description	Potential ARAR or TBC Guidance?	Comment
A. Federal Chemical Specific ARARs				
There are no chemical specific ARARs for soil.				
TBC Guidance				
A Guide to Delisting RCRA Wastes for Superfund Remedial Response	EPA Directive #9347-09FS	Establishes soil cleanup levels based on 1×10^{-6} health risk devel- oped for delisting hazardous wastes and waste residuals.	YES	
Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites	EPA Directive #9355.4-02, September 1989	Established guidance cleanup levels for lead contaminated soils.	YES	If lead is found as a contaminant, requirements will be considered.
Air Contaminants (OSHA)	29 CFR 1910.1000	Sets Permissible Exposure Limits for air contaminants.	YES	
Chemical specific exposure levels	ACGIH 1991-1992 and NIOSH 1990	Sets chemical specific worker exposure levels.	YES	
General Environmental Protection Program	DOE Order 5400.1	Establishes requirements, authori- ties, and responsibilities for the compliance of DOE operations with Federal, State, and local envi- ronmental laws and regulations.	YES	
Radiation Protection of the Public and the Environment	DOE Order 5400.5	Establishes standards and require- ments for DOE operations regard- ing the protection of the public and environment from radiation. Establishes radionuclide-specific contamination limits.	YES	
Radiation Waste Management	DOE Order 5820.2A	Establishes policies and guide- lines for the management of transuranic waste.	YES	

Standard, Requirement Criteria, or Limitation	Citation	Description	Potential ARAR or TBC Guidance?	Comment
Atomic Energy Act	10 CFR Part 20.101 through 105	Protection of individuals in restricted areas (i.e., workers) and unrestricted areas from radiation exposure.	YES	Excavated soils may contain radionuclides.
	10 CFR Part 20.106	Sets radionuclide-specific concentration limits for discharges to unrestricted areas.	YES	Excavated soils may contain radionuclides.
	10 CFR Part 20.106	Sets concentration limits for radioactive waste treatment and disposal.	NO	Requirements are for disposal of radioactive wastes into sanitary systems and incinerations.

B. Federal Location Specific ARARs

Endangered Species Act; Wildlife and Fisheries General Provisions; Migratory Bird Hunting and Permits; Protection of Bald and Golden Eagles	50 CFR Part 402.01 and 402.04; 50 CFR 10, 20-21, and 16 USC §§ 668,703-711, and 1531	Establishes minimum requirements for the protection of endangered species from destruction or adverse modification of their habitat.	YES	Endangered species will be considered during design of interim action.
Protection and Conservation of Wildlife	40 CFR 6.304 and 16 USC § 661	Establishes actions to be taken to protect wildlife resources that may be affected by remedial actions resulting in the control or structural modification of any natural stream or body of water.	YES	Natural streams will be considered during design of interim action.
Executive Order on Protection of Wetlands	Executive Order No. 11, 990; 40 CFR Section 6.302(b) and Appendix A	Requires federal agencies to evaluate potential effects of actions they may take in wetlands to minimize adverse impacts to wetlands.	YES	Wetlands will be considered during design of interim action.
Executive Order on Floodplain Management	Executive Order No. 11, 988; 40 CFR Section 6.302(b) and Appendix A	Requires federal agencies to evaluate potential effects of actions they may take in a floodplain to avoid, to maximum extent possible, adverse impacts associated with direct and indirect development of a floodplain.	YES	Floodplains will be considered during design of interim action.

Standard, Requirement Criteria, or Limitation	Citation	Description	Potential ARAR or TBC Guidance?	Comment
C. Federal Action Specific ARARs				
Clean Air Act	42 U.S.C. §§ 7401-7642			
Protection of Visibility and Air Programs Protection of Visibility	40 CFR 51.300-307 and 40 CFR 52.26-29	Sets visibility standards for air emission.	YES	
Standard of Performance for New Source Designation Areas	40 CFR 81.306	Sets total suspended solids standards for air emission.	YES	
National Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Sets emission standards for carbon dioxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur oxides.	YES	Applies to Air Quality Control Regions, not individual sites, unless emissions adversely affect Regional standards.
National Emissions Standards for Hazardous Air Pollutants (NESHAPs)	40 CFR Part 61	Sets emission standards for designated hazardous pollutants.	YES	Standards for benzene and radionuclides may apply.
Solid Waste Disposal Act (SWDA)	40 U.S.C. §§ 6901-6987			
Identification and Listing of Hazardous Wastes.	40 CFR 261	Determination of Hazardous Wastes.	YES	
Standards Applicable to Generators of Hazardous Waste	40 CFR Part 260 and 262	Hazardous Waste Management System; establishes standards for generators of hazardous waste (waste determining and manifesting).	YES	Excavation or consolidation of soil and sludge may constitute generation of a RCRA hazardous waste.
Standards Applicable to Transporters of Hazardous Waste	40 CFR Part 263	Hazardous waste shipped off site must comply with this section which adopts DOT transportation standards and manifesting requirements.	YES	Applicable if hazardous waste is sent off site.
Standards for Owners and Operators of Hazardous Waste	40 CFR Part 264	Establishes minimum standards which define the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or dispose of hazardous waste.	YES	Hazardous waste may be treated on and off site.

Standard, Requirement Criteria, or Limitation	Citation	Description	Potential ARAR or TBC Guidance?	Comment
• General Facility Standards - Financial Requirements	Subparts B through E	Regulation of design and operation of hazardous waste treatment and storage unit.	YES	If hazardous waste is treated, stored, or disposed of, the regulations for design and operation for that unit or process are applicable.
• Use and Management of Containers	Subpart I	Establishes standards for storage of hazardous waste or materials in containers.	YES	If containers are used to store waste, requirements are applicable.
• Tanks	Subpart J	Establishes standards for use of tanks to treat or store hazardous wastes.	YES	If waste is treated in a tank, requirements are applicable.
• Surface Impoundments	Subpart K	Establishes standards to treat, store, or dispose of hazardous waste in surface impoundments.	YES	If waste is treated in surface impoundment, requirements are applicable.
• Waste Piles	Subpart L	Establishes standards for storage or treatment of hazardous waste in piles.	YES	Temporary storage prior to treatment is not subject to standards.
• Landfills	Subpart N	Establishes standards for disposal of hazardous wastes in a landfill.	YES	If waste is disposed in a landfill, requirements are applicable.
• Incinerators	Subpart O	Establishes standards for incinerators.	NO	Waste incineration is not planned.
• Organic Air Emission Standards for Process Vents, Equipment Leaks	Subpart AA	Standards for emissions from air stripping of VOCs.	NO	Air stripping or thermal extraction is not planned.
Land Disposal Restrictions	40 CFR Part 268	Identifies RCRA hazardous wastes restricted from land disposal and circumstances under which waste may be land disposed.	YES	Applies to treatment, storage and disposal of waste and soil containing waste.
Hazardous Materials Transportation Act	49 U.S.C. §§ 1801-1813			
Hazardous Materials Transportation Regulations	49 CFR Parts 107, 171-177	Regulates transportation of hazardous materials.	YES	Standards applicable to off site transportation of waste.

Standard, Requirement Criteria, or Limitation	Citation	Description	Potential ARAR or TBC Guidance?	Comment
Toxic Substances Control Act	15 U.S.C. §§ 2601-2629		YES	For soil containing waste, land disposal restriction levels are target for cleanup.
PCB Requirements	40 CFR Part 761; 52 FR 10688 April 2, 1987	Establishes storage and disposal requirements for PCBs.	YES	If PCBs are found in the remediated waste, the requirements of TSCA for disposal of PCBs are required and applicable.
TBC Guidance				
Atomic Energy Act	10 CFR Part 20.106	Sets radionuclide-specific concentration limits for discharges to unrestricted areas.	YES	Excavated soil may contain radionuclides.
	10 CFR Part 20.301 through 311; 20.302 (a) and (b)	Sets radioactive waste treatment and disposal requirements.	YES	Excavated soil may contain radionuclides.
Occupational Safety and Health Act	29 U.S.C. §§ 651-678	Regulates worker health and safety.	YES	Hazardous waste site activities worker protection will apply (40 CFR 300.38).
Occupational Safety and Health Standards	29 CFR 1910	Provides guidelines for workers engaged in activities requiring protective health and safety measures regulated by OSHA.	YES	
Safety and Health Regulations for Construction and Excavation	29 CFR 1926 Subpart B	Guidelines for workers involved in activities related to construction and utilization of trenches and ditches.	YES	
Hazardous Waste Operations and Emergency Response (OSHA)	29 CFR 1910.120(b)	Requires a site specific safety and health plan and training program.	YES	

State Contaminant Specific ARARs

Radiation Control	6 CCR 1007-1	State regulations regarding radiation and radioactive wastes.	YES	
-------------------	--------------	---	-----	--

Standard, Requirement Criteria, or Limitation	Citation	Description	Potential ARAR or TBC Guidance?	Comment
--	----------	-------------	------------------------------------	---------

E. State Location Specific ARARs

State location-specific ARARs exist for surface water only

F. State Action Specific ARARs

Colorado Air Quality Control Act	C.R.S. §§ 25-7-101 to 505			
Emission Control Regulations	5 Colorado Code of Regulations (CCR) 1001-2	Sets air emission standards.	NO	Found to be relevant and appropriate; however, does not specifically address remedial actions under CERCLA.
• Regulation No. 1	5 CCR 1001-3	Establishes emission control regulations for particulate, smokes, carbon monoxide, sulfur oxides, and fugitive particulate emissions.	NO	Found to be relevant and appropriate for fugitive emissions and opacity standards; however, do not specifically address remedial actions under CERCLA.
• Regulation No. 2	5 CCR 1001-4	Establishes odor emission regulations.	NO	Found to be relevant and appropriate; however, does not specifically address remedial actions under CERCLA.
• Regulation No. 3	5 CCR 1001-5	Establishes permit requirements for construction or modification of stationary sources and regulations for prevention of significant deterioration.	NO	
• Regulation No. 6	5 CCR 1001-8	Establishes new source performance standards for incinerators, storage vessels for petroleum liquids, sewage treatment plants, new fuel burning equipment, and new sources of sulfur dioxide.	NO	Regulation is for incinerators and generators as stationary sources.

Standard, Requirement Criteria, or Limitation	Citation	Description	Potential ARAR or TBC Guidance?	Comment
• Regulation No. 7	5 CCR 1001-9	Regulations to control emissions of volatile organic compounds.	NO	Found to be relevant and appropriate; however, does not specifically address remedial actions under CERCLA.
• Regulation No. 8	5 CCR 1001-10	Sets forth emission control requirements for hazardous air pollutants, including beryllium, mercury and lead.	NO	Found to be relevant and appropriate; however, does not specifically address remedial actions under CERCLA.
• Regulation No. 12	5 CCR 1001-15	Air emission standards for diesel vehicles associated with excavation and backfill operations.	YES	
Ambient Air Quality Standards	5 CCR 1001-14	Sets ambient standards for total suspended particulates, sulfur dioxide, oxides, carbon monoxide, and nitrogen dioxide.	YES	Applies to Air Quality Control Regions, not individual sites, unless emissions adversely affect Regional Standards.
Radiation Control	CRS §25-11 Part 1 and 2	Provides the general provisions and guidelines for radioactive waste disposal.	YES	
Licensing Requirements for Land Disposal of Low-Level Radioactive Wastes	6 CCR 1007-1 Part 14	Establishes the requirements for land disposal of low-level radioactive wastes.	YES	
Colorado Low-Level Radioactive Waste Rate Regulations	6 CCR 1007-1 Part 15	Provides the standards for low-level radioactive wastes.	YES	
Transportation of Radioactive Materials	6 CCR 1007-1 Part 17	Regulations for the transport of radioactive wastes.	YES	
Colorado Hazardous Waste Act (HWA)	C.R.S. § 25-15-101 to 313			
Hazardous Waste Disposal Site	C.R.S. § 25-15-200 to 220	Provides the guidelines and requirements for hazardous waste disposal sites.	YES	
Rules and Regulations Pertaining to Hazardous Waste	6 CCR 1007-3		YES	Requirements will apply to any newly generated waste.

Standard, Requirement Criteria, or Limitation	Citation	Description	Potential ARAR or TBC Guidance?	Comment
Standards Applicable to Gen- erators of Hazardous Waste	Part 262	Establishes standards for genera- tors of hazardous waste (waste determining and manifesting).	YES	Requirements will apply to waste excavated and generated during the response action.
Standards Applicable to Trans- porters of Hazardous Waste	Part 99, 262, 263 and 268	Shipment of hazardous waste shipped off site must comply with this section which adopts DOT transportation standards and man- ifesting requirements.	YES	Off site shipments of waste must be manifested as hazardous waste and comply with all transportation standards.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Dis- posal Facilities	Part 264	Establishes minimum standards which define the acceptable man- agement of hazardous waste for owners and operators of facilities which treat, store, or dispose of hazardous waste.	YES	Hazardous waste is treated on and off site.
• General Facility Stan- dards - Financial Re- quirements	Subparts B through E		YES	If hazardous waste is treated, stored, or disposed of, the regula- tion for design and operation for that unit or process is applicable.
• Release from Solid Waste Management Units	Subpart F	Standards applying to units which store waste from which a release has occurred (including ground water monitoring and protection standards).	YES	If there is a release, requirements are applicable.
• Closure and Post-Closure	Subpart G	Standards that apply to the con- trols and monitoring of waste in a unit that is no longer operational.	YES	Treated soil containing waste re- turned to an area of contamination is subject to these standards.
• Use and Management of Containers	Subpart I	Establishes standards for storage of hazardous waste or materials in containers.	YES	If containers are used to store waste, requirements are applicable.
• Tanks	Subpart J	Establishes standards for use of tanks to treat or store hazardous wastes.	YES	If waste is treated in a tank, re- quirements are applicable.
• Surface Impoundments	Subpart K	Establishes standards to treat, store, or dispose of hazardous wastes.	YES	If waste is treated in surface im- poundments, requirements are applicable.

144

Standard, Requirement Criteria, or Limitation	Citation	Description	Potential ARAR or TBC Guidance?	Comment
• Waste Piles	Subpart L	Establishes standards for storage or treatment of hazardous waste in piles.	NO/YES	Temporary storage prior to treatment is not subject to standards.
• Landfills	Subpart N	Establishes standards for disposal of hazardous wastes in a landfill.	YES	If waste is landfilled, requirements are applicable.
• Incinerators	Subpart O	Establishes standards for incinerators.	NO	Waste incineration is not planned.
Interim Status Standards	Part 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.	YES	
Colorado Financial Requirements	Part 266		YES	If hazardous waste is treated, stored, or disposed of, the regulation for design and operation for that unit or process is applicable.
Hazardous Waste Sites	C.R.S. 25-16-101 to 200	Cleanup (State's Response to CERCLA).	YES	
Hazardous Waste Disposal Sites	6 CCR 1007-2 Part 2	Requirements for siting of Hazardous Waste Disposal Sites.	YES	
	Sections 1 through 3	Defines the scope and application requirements for Certificates of Designation.	YES	
	Sections 4 through 5	Defines the minimum design criteria and requirements for Hazardous Waste Landfills.	YES	
	Sections 6 through 7	Defines the Minimum design criteria and requirements for Surface impoundments.	YES	
Water Quality Control	C.R.S. 25-8-101 through 703		YES	
	C.R.S. 25-8-506	Nuclear and radioactive wastes that can be remotely discharged to surface or groundwater via surface soil disturbance.	YES	Applicable if IM/IRA has potential to impact surface water or ground water.

Standard, Requirement Criteria, or Limitation	Citation	Description	Potential ARAR or TBC Guidance?	Comment
Colorado Wildlife Enforcement and Penalties	C.R.S. §§ 33-1-101, <u>et seq.</u>	Prohibits actions detrimental to wildlife.	Yes	During the design phase of the Interim actions, consideration will be given to the protection of wildlife.
Colorado Noise Abatement Statute	C.R.S. §§ 25-12-101, <u>et seq.</u>	Establishes standards for controlling noise.	YES	While not an ARAR, applicable standards will be met during construction activities.

APPENDIX D
PROGRAMMATIC RISK-BASED PRELIMINARY REMEDIATION GOALS

(From "Programmatic Risk-Based Preliminary Remediation Goals"
July 1994 currently under review by EPA and CDH)

TABLE 26
PROGRAMMATIC PRGs FOR ROCKY FLATS PLANT

Target Analyte List Chemical	Residential Groundwater (mg/L)	Residential Surface Water Swimming (mg/L)	Residential Soil (mg/kg)	Office Worker Soil (mg/kg)	Construction Worker Subsurface Soil (mg/kg)	Wading Ecological Worker (mg/L)	Soil Ecological Worker (mg/kg)
Acenaphthene#	2.19E+00	1.68E+03	1.65E+04	1.23E+05	1.02E+06	4.38E+03	1.48E+05
Acenaphthylene#	-	-	-	-	-	-	-
Acetone#	3.65E+00	2.81E+03	2.74E+04	2.04E+05	1.70E+06	7.30E+03	2.47E+05
Aldrin	5.00E-06	3.85E-03	3.77E-02	3.36E-01	7.01E+01	1.20E-01	4.07E-01
Aluminum	-	-	-	-	-	-	-
Anthracene#	1.09E+01	8.42E+03	8.23E+04	6.13E+05	5.11E+06	2.19E+04	7.41E+05
Antimony	1.46E-02	1.12E+01	1.10E+02	8.18E+02	6.81E+03	2.92E+01	9.87E+02
Aroclor-1016	1.10E-05	8.51E-03	8.32E-02	7.43E-01	1.55E+02	2.65E-01	8.98E-01
Aroclor-1221	1.10E-05	8.51E-03	8.32E-02	7.43E-01	1.55E+02	2.65E-01	8.98E-01
Aroclor-1232	1.10E-05	8.51E-03	8.32E-02	7.43E-01	1.55E+02	2.65E-01	8.98E-01
Aroclor-1242	1.10E-05	8.51E-03	8.32E-02	7.43E-01	1.55E+02	2.65E-01	8.98E-01
Aroclor-1248	1.10E-05	8.51E-03	8.32E-02	7.43E-01	1.55E+02	2.65E-01	8.98E-01
Aroclor-1254	1.10E-05	8.51E-03	8.32E-02	7.43E-01	1.55E+02	2.65E-01	8.98E-01
Aroclor-1260	1.10E-05	8.51E-03	8.32E-02	7.43E-01	1.55E+02	2.65E-01	8.98E-01
Arsenic	4.86E-05	3.74E-02	3.66E-01	3.27E+00	6.81E+02	1.17E+00	3.95E+00
Barium	2.56E+00	1.97E+03	1.92E+04	1.41E+05	1.19E+06	5.11E+03	1.73E+05
Benzene#	6.15E-04	2.26E+00	2.21E+01	1.66E-01	3.27E+00	7.05E+01	2.38E+02
alpha-BHC	1.35E-05	1.04E-02	1.02E-01	9.08E-01	1.89E+02	3.24E-01	1.10E+00
beta-BHC	4.72E-05	3.64E-02	3.56E-01	3.18E+00	6.62E+02	1.14E+00	3.84E+00
delta-BHC	-	-	-	-	-	-	-
gamma-BHC (Lindane)	6.54E-05	5.04E-02	4.93E-01	4.40E+00	9.17E+02	1.57E+00	5.32E+00
Benzo(a)anthracene	1.16E-04	8.97E-02	8.77E-01	7.84E+00	1.63E+03	2.80E+00	9.47E+00
Benzo(a)pyrene	1.16E-05	8.97E-03	8.77E-02	7.84E-01	1.63E+02	2.80E-01	9.47E-01
Benzo(b)fluoranthene	1.16E-04	8.97E-02	8.77E-01	7.84E+00	1.63E+03	2.80E+00	9.47E+00
Benzo(g,h,i)perylene	-	-	-	-	-	-	-
Benzo(k)fluoranthene	1.16E-03	8.97E-01	8.77E+00	7.84E+01	1.63E+04	2.80E+01	9.47E+01
Benzoic Acid	1.46E+02	1.12E+05	1.10E+06	8.18E+06	6.81E+07	2.92E+05	9.87E+06
Benzyl Alcohol	1.09E+01	8.42E+03	8.23E+04	6.13E+05	5.11E+06	2.19E+04	7.41E+05
Beryllium	1.98E-05	1.52E-02	1.49E-01	1.33E+00	2.77E+02	4.75E-01	1.61E+00
bis(2-Chloroethoxy)methane#	-	-	-	-	-	-	-
bis(2-Chloroethyl)ether#	1.56E-05	5.95E-02	5.82E-01	6.29E+00	1.08E+03	1.86E+00	6.28E+00
bis(2-Chloroisopropyl)ether#	4.22E-04	9.36E-01	9.15E+00	4.00E-01	1.70E+04	2.92E+01	9.87E+01
bis(2-Ethylhexyl)phthalate	6.07E-03	4.68E+00	4.57E+01	4.09E+02	8.51E+04	1.46E+02	4.94E+02
Bromodichloromethane#	1.37E-03	1.06E+00	1.03E+01	3.55E-01	1.92E+04	3.30E+01	1.11E+02
Bromoform#	3.81E-03	8.29E+00	8.11E+01	4.52E-02	1.51E+05	2.59E+02	8.75E+02
Bromomethane#	1.09E-02	3.93E+01	3.84E+02	2.86E+03	2.38E+04	1.02E+02	3.46E+03

TABLE 26
PROGRAMMATIC PRGs FOR ROCKY FLATS PLANT

Target Analyte List Chemical	Residential Groundwater (mg/L)	Residential Surface Water Swimming (mg/L)	Residential Soil (mg/kg)	Office Worker Soil (mg/kg)	Construction Worker Subsurface Soil (mg/kg)	Wading Ecological Worker (mg/L)	Soil Ecological Worker (mg/kg)
4-Bromophenyl phenyl ether	-	-	-	-	-	-	-
2-Butanone#	2.47E+00	1.68E+04	1.65E+05	1.23E+06	1.02E+07	4.38E+04	1.48E+06
Butylbenzylphthalate	7.30E+00	5.62E+03	5.49E+04	4.09E+05	3.41E+06	1.46E+04	4.94E+05
Cadmium	1.82E-02	1.40E+01	1.37E+02	1.02E+03	8.52E+03	3.65E+01	1.23E+03
Calcium	-	-	-	-	-	-	-
Carbon disulfide#	2.76E-02	2.81E+03	2.74E+04	2.04E+05	1.70E+06	7.30E+03	2.47E+05
Carbon tetrachloride#	2.60E-04	5.04E-01	4.93E+00	4.40E+01	1.03E+00	1.57E+01	5.32E+01
Cesium	-	-	-	-	-	-	-
alpha-Chlordane	6.54E-05	5.04E-02	4.93E-01	4.40E+00	9.17E+02	1.57E+00	5.32E+00
beta-Chlordane	6.54E-05	5.04E-02	4.93E-01	4.40E+00	9.17E+02	1.57E+00	5.32E+00
gamma-Chlordane	6.54E-05	5.04E-02	4.93E-01	4.40E+00	9.17E+02	1.57E+00	5.32E+00
4-Chloroaniline	1.46E-01	1.12E+02	1.10E+03	8.18E+03	6.81E+04	2.92E+02	9.87E+03
Chlorobenzene#	5.16E-02	5.62E+02	5.49E+03	4.09E+04	2.11E+01	1.46E+03	4.94E+04
Chloroethane#	2.78E+01	-	-	-	1.77E+03	-	-
Chloroform#	2.76E-04	1.07E+01	1.05E+02	3.49E-02	1.70E+05	3.35E+02	1.13E+03
Chloromethane#	2.32E-03	5.04E+00	4.93E+01	7.44E-02	9.17E+04	1.57E+02	5.32E+02
4-Chloro-3-methylphenol	-	-	-	-	-	-	-
2-Chloronaphthalene#	2.92E+00	2.25E+03	2.20E+04	1.64E+05	1.36E+06	5.84E+03	1.97E+05
2-Chlorophenol#	1.82E-01	1.40E+02	1.37E+03	1.02E+04	8.52E+04	3.65E+02	1.23E+04
4-Chlorophenyl phenyl ether	-	-	-	-	-	-	-
Chromium III	3.65E+01	2.81E+04	2.74E+05	2.04E+06	1.70E+07	7.30E+04	2.47E+06
Chromium VI	1.82E-01	1.40E+02	9.62E+02	4.88E+03	8.52E+04	3.65E+02	1.23E+04
Chrysene	1.16E-02	8.97E+00	8.77E+01	7.84E+02	1.63E+05	2.80E+02	9.47E+02
Cobalt	-	-	-	-	-	-	-
Copper	1.46E+00	1.12E+03	1.10E+04	8.18E+04	6.81E+05	2.92E+03	9.87E+04
Cyanide	7.30E-01	5.62E+02	5.49E+03	4.09E+04	3.41E+05	1.46E+03	4.94E+04
4,4-DDD	3.54E-04	2.73E-01	2.67E+00	2.38E+01	4.97E+03	8.52E+00	2.88E+01
4,4-DDE	2.50E-04	1.93E-01	1.88E+00	1.68E+01	3.51E+03	6.01E+00	2.03E+01
4,4-DDT	2.50E-04	1.93E-01	1.88E+00	1.68E+01	3.51E+03	6.01E+00	2.03E+01
Dibenz(a,h)anthracene	1.16E-05	8.97E-03	8.77E-02	7.84E-01	1.63E+02	2.80E-01	9.47E-01
Dibenzofuran	-	-	-	-	-	-	-
Dibromochloromethane	1.01E-03	7.80E-01	7.62E+00	6.81E+01	1.42E+04	2.43E+01	8.23E+01
Di-n-butylphthalate	3.65E+00	2.81E+03	2.74E+04	2.04E+05	1.70E+06	7.30E+03	2.47E+05
1,2-Dichlorobenzene#	4.76E-01	2.53E+03	2.47E+04	1.84E+05	1.53E+06	6.57E+03	2.22E+05
1,3-Dichlorobenzene#	-	-	-	-	-	-	-
1,4-Dichlorobenzene#	3.54E-03	2.73E+00	2.67E+01	1.37E-01	4.97E+04	8.52E+01	2.88E+02
3,3-Dichlorobenzidine	1.89E-04	1.46E-01	1.42E+00	1.27E+01	2.65E+03	4.54E+00	1.54E+01

11/1

TABLE 26
PROGRAMMATIC PRGs FOR ROCKY FLATS PLANT

Target Analyte List Chemical	Residential Groundwater (mg/L)	Residential Surface Water Swimming (mg/L)	Residential Soil (mg/kg)	Office Worker Soil (mg/kg)	Construction Worker Subsurface Soil (mg/kg)	Wading Ecological Worker (mg/L)	Soil Ecological Worker (mg/kg)
1,1-Dichloroethane#	1.01E+00	2.81E+03	2.74E+04	2.04E+05	1.29E+02	7.30E+03	2.47E+05
1,2-Dichloroethane#	1.97E-04	7.20E-01	7.04E+00	5.21E-01	1.31E+04	2.25E+01	7.60E+01
1,1-Dichloroethene#	1.67E-05	1.09E-01	1.07E+00	3.43E+00	1.99E+03	3.41E+00	1.15E+01
1,2-Dichloroethene (total)#	3.28E-01	2.53E+02	2.47E+03	1.84E+04	1.53E+05	6.57E+02	2.22E+04
2,4-Dichlorophenol	1.10E-01	8.42E+01	8.23E+02	6.13E+03	5.11E+04	2.19E+02	7.41E+03
1,2-Dichloropropane#	1.25E-03	9.63E-01	9.42E+00	3.89E-01	1.75E+04	3.01E+01	1.02E+02
cis-1,3-Dichloropropene#	1.27E-04	3.64E-01	3.56E+00	1.03E+00	5.11E+03	1.14E+01	3.84E+01
trans-1,3-Dichloropropene#	1.27E-04	3.64E-01	3.56E+00	1.03E+00	5.11E+03	1.14E+01	3.84E+01
Dieldrin	5.31E-06	4.09E-03	4.00E-02	3.57E-01	7.45E+01	1.28E-01	4.32E-01
Diethylphthalate	2.92E+01	2.25E+04	2.20E+05	1.64E+06	1.36E+07	5.84E+04	1.97E+06
2,4-Dimethylphenol#	7.30E-01	5.62E+02	5.49E+03	4.09E+04	3.41E+05	1.46E+03	4.94E+04
Dimethylphthalate	3.65E+02	2.81E+05	2.74E+06	2.04E+07	1.70E+08	7.30E+05	2.47E+07
4,6-Dinitro-2-methylphenol#	-	-	-	-	-	-	-
2,4-Dinitrophenol	7.30E-02	5.62E+01	5.49E+02	4.09E+03	3.41E+04	1.46E+02	4.94E+03
2,4-Dinitrotoluene	7.30E-02	5.62E+01	5.49E+02	4.09E+03	3.41E+04	1.46E+02	4.94E+03
2,6-Dinitrotoluene	3.65E-02	2.81E+01	2.74E+02	2.04E+03	1.70E+04	7.30E+01	2.47E+03
Di-n-octylphthalate	7.30E-01	5.62E+02	5.49E+03	4.09E+04	3.41E+05	1.46E+03	4.94E+04
Endosulfan I	1.83E-03	1.40E+00	1.37E+01	1.02E+02	8.52E+02	3.65E+00	1.23E+02
Endosulfan II	1.83E-03	1.40E+00	1.37E+01	1.02E+02	8.52E+02	3.65E+00	1.23E+02
Endosulfan sulfate	1.83E-03	1.40E+00	1.37E+01	1.02E+02	8.52E+02	3.65E+00	1.23E+02
Endosulfan (technical)	1.83E-03	1.40E+00	1.37E+01	1.02E+02	8.52E+02	3.65E+00	1.23E+02
Endrin ketone	-	-	-	-	-	-	-
Endrin (technical)	1.09E-02	8.42E+00	8.23E+01	6.13E+02	5.11E+03	2.19E+01	7.41E+02
Ethylbenzene#	1.58E+00	2.81E+03	2.74E+04	2.04E+05	1.52E+03	7.30E+03	2.47E+05
Fluoranthene	1.46E+00	1.12E+03	1.10E+04	8.18E+04	6.81E+05	2.92E+03	9.87E+04
Fluorene#	1.46E+00	1.12E+03	1.10E+04	8.18E+04	6.81E+05	2.92E+03	9.87E+04
Heptachlor	1.89E-05	1.46E-02	1.42E-01	1.27E+00	2.65E+02	4.54E-01	1.54E+00
Heptachlor epoxide	9.34E-06	7.20E-03	7.04E-02	6.29E-01	1.31E+02	2.25E-01	7.60E-01
Hexachlorobenzene	5.31E-05	4.09E-02	4.00E-01	3.57E+00	7.45E+02	1.28E+00	4.32E+00
Hexachlorobutadiene	-	-	-	2.60E+06	5.40E+08	-	-
Hexachlorocyclopentadiene	2.56E-01	1.97E+02	1.92E+03	1.42E+04	1.19E+05	5.11E+02	1.73E+04
Hexachloroethane	6.07E-03	4.68E+00	4.57E+01	4.09E+02	1.70E+04	7.30E+01	4.94E+02
2-Hexanone#	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	1.16E-04	8.97E-02	8.77E-01	7.84E+00	1.63E+03	2.80E+00	9.47E+00
Iron	-	-	-	-	-	-	-
Isophorone	8.95E-02	6.89E+01	6.74E+02	6.02E+03	1.25E+06	2.15E+03	7.28E+03
Lead	-	-	-	-	-	-	-

12

TABLE 26
PROGRAMMATIC PRGs FOR ROCKY FLATS PLANT

Target Analyte List Chemical	Residential Groundwater (mg/L)	Residential Surface Water Swimming (mg/L)	Residential Soil (mg/kg)	Office Worker Soil (mg/kg)	Construction Worker Subsurface Soil (mg/kg)	Wading Ecological Worker (mg/L)	Soil Ecological Worker (mg/kg)
Lithium	-	-	-	-	-	-	-
Magnesium	-	-	-	-	-	-	-
Manganese	1.82E-01	1.40E+02	1.37E+03	1.01E+04	8.52E+04	3.65E+02	1.23E+04
Mercury	1.09E-02	8.42E+00	8.23E+01	6.13E+02	5.11E+03	2.19E+01	7.41E+02
Methoxychlor	1.82E-01	1.40E+02	1.37E+03	1.02E+04	8.52E+04	3.65E+02	1.23E+04
Methylene chloride#	6.22E-03	8.73E+00	8.54E+01	4.29E-02	1.59E+05	2.73E+02	9.22E+02
2-Methylnaphthalene#	-	-	-	-	-	-	-
4-Methyl-2-pentanone#	1.98E-01	1.40E+03	1.37E+04	1.02E+05	8.52E+05	3.65E+03	1.23E+05
2-Methylphenol	1.83E+00	1.40E+03	1.37E+04	1.02E+05	8.52E+05	3.65E+03	1.23E+05
4-Methylphenol	1.82E-01	1.40E+02	1.37E+03	1.02E+04	8.52E+04	3.65E+02	1.23E+04
Molybdenum	1.82E-01	1.40E+02	1.37E+03	1.02E+04	8.52E+04	3.65E+02	1.23E+04
Naphthalene#	1.46E+00	1.12E+03	1.10E+04	8.18E+04	6.81E+05	2.92E+03	9.87E+04
Nickel	7.30E-01	5.62E+02	5.49E+03	4.09E+04	3.41E+05	1.46E+03	4.94E+04
2-Nitroaniline	-	-	-	-	-	-	-
3-Nitroaniline	-	-	-	-	-	-	-
4-Nitroaniline	-	-	-	-	-	-	-
Nitrobenzene#	4.26E-03	1.40E+01	1.37E+02	1.02E+03	8.52E+03	3.65E+01	1.23E+03
2-Nitrophenol	-	-	-	-	-	-	-
4-Nitrophenol#	-	-	-	-	-	-	-
n-Nitrosodiphenylamine#	1.73E-02	1.34E+01	1.31E+02	2.80E-02	2.43E+05	4.17E+02	1.41E+03
n-Nitrosodipropylamine	1.21E-05	9.36E-03	9.15E-02	8.17E-01	1.70E+02	2.92E-01	9.87E+01
Pentachlorophenol	7.08E-04	5.46E-01	5.34E+00	4.77E+01	9.93E+03	1.70E+01	5.76E+01
Phenanthrene#	-	-	-	-	-	-	-
Phenol	2.19E+01	1.68E+04	1.65E+05	1.23E+06	1.02E+07	4.38E+04	1.48E+06
Potassium	-	-	-	-	-	-	-
Pyrene	1.09E+00	8.42E+02	8.23E+03	6.13E+04	5.11E+05	2.19E+03	7.41E+04
Selenium	1.82E-01	1.40E+02	1.37E+03	1.02E+04	8.52E+04	3.65E+02	1.23E+04
Silver	1.82E-01	1.40E+02	1.37E+03	1.02E+04	8.52E+04	3.65E+02	1.23E+04
Sodium	-	-	-	-	-	-	-
Strontium	2.19E+01	1.68E+04	1.65E+05	1.23E+06	1.02E+07	4.38E+04	1.48E+06
Styrene#	2.01E+00	5.62E+03	5.49E+04	4.09E+05	3.41E+06	1.46E+04	4.94E+05
1,1,2,2-Tetrachloroethane#	8.95E-05	3.28E-01	3.20E+00	1.14E+00	5.96E+03	1.02E+01	3.46E+01
Tetrachloroethene#	1.43E-03	1.26E+00	1.23E+01	2.97E-01	4.94E+01	3.93E+01	1.33E+02
Thallium	-	-	-	-	-	-	-
Tin	2.19E+01	1.68E+04	-	1.23E+06	1.02E+07	4.38E+04	1.48E+06
Toluene#	9.65E-01	5.62E+03	5.49E+04	4.09E+05	2.94E+02	1.46E+04	4.94E+05
Toxaphene	7.73E-05	5.95E-02	5.82E-01	5.20E+00	1.08E+03	1.86E+00	6.28E+00

173

TABLE 26
PROGRAMMATIC PRGs FOR ROCKY FLATS PLANT

Target Analyte List Chemical	Residential Groundwater (mg/L)	Residential Surface Water Swimming (mg/L)	Residential Soil (mg/kg)	Office Worker Soil (mg/kg)	Construction Worker Subsurface Soil (mg/kg)	Wading Ecological Worker (mg/L)	Soil Ecological Worker (mg/kg)
1,2,4-Trichlorobenzene#	2.34E-02	2.81E+02	2.74E+03	2.04E+04	1.70E+05	7.30E+02	2.47E+04
1,1,1-Trichloroethane#	-	-	-	-	-	-	-
1,1,2-Trichloroethane#	3.18E-04	1.15E+00	1.12E+01	3.26E-01	2.09E+04	3.59E+01	1.21E+02
Trichloroethene#	2.55E-03	5.95E+00	5.82E+01	6.29E-02	1.08E+05	1.86E+02	6.28E+02
2,4,5-Trichlorophenol	3.65E+00	2.81E+03	2.74E+04	2.04E+05	1.70E+06	7.30E+03	2.47E+05
2,4,6-Trichlorophenol	7.73E-03	5.95E+00	5.82E+01	5.20E+02	1.08E+05	1.86E+02	6.28E+02
Vanadium	2.56E-01	1.97E+02	1.92E+03	1.43E+04	1.19E+05	5.11E+02	1.73E+04
Vinyl acetate	3.65E+01	2.81E+04	2.74E+05	2.04E+06	1.70E+07	7.30E+04	2.47E+06
Vinyl chloride#	2.81E-05	3.45E-02	3.37E-01	1.09E+01	6.27E+02	1.08E+00	3.64E+00
Xylene (total)#	7.30E+01	5.62E+04	5.49E+05	4.09E+06	3.41E+07	1.46E+05	4.94E+06
Zinc	1.09E+01	8.42E+03	8.23E+04	6.13E+05	5.11E+06	2.19E+04	7.41E+05
Nitrate	5.84E+01	4.49E+04	4.39E+05	3.27E+06	2.73E+07	1.17E+05	3.95E+06
Nitrite	3.65E+00	2.81E+03	2.74E+04	2.04E+05	1.70E+06	7.30E+03	2.47E+05
pH	-	-	-	-	-	-	-
Sulfide	-	-	-	-	-	-	-
Ammonium	-	-	-	-	-	-	-
Bicarbonate	-	-	-	-	-	-	-
Bromide	-	-	-	-	-	-	-
Carbonate	-	-	-	-	-	-	-
Chloride	-	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-	-
Fluoride	2.19E+00	1.68E+03	1.65E+04	1.23E+05	1.02E+06	4.38E+03	1.48E+05
Orthophosphate	-	-	-	-	-	-	-
Silica (as Si and SiO ₂)	-	-	-	-	-	-	-
Sulfate	-	-	-	-	-	-	-
Americium-241	1.98E-01 *	1.53E+02 *	2.37E+00 **	9.55E+00 **	6.50E+02 **	4.76E+03 *	1.09E+01 **
Cesium-137	1.70E+00 *	1.31E+03 *	2.83E+01 **	1.14E+02 **	2.38E+04 **	4.08E+04 *	1.38E+02 **
Plutonium-239	2.07E-01 *	1.59E+02 *	3.43E+00 **	1.38E+01 **	2.85E+03 **	4.97E+03 *	1.67E+01 **
Plutonium-240	2.07E-01 *	1.59E+02 *	3.42E+00 **	1.38E+01 **	2.83E+03 **	4.97E+03 *	1.67E+01 **
Radium-226	3.97E-01 *	3.05E+02 *	2.28E+00 **	9.13E+00 **	3.27E+02 **	9.52E+03 *	9.70E+00 **
Radium-228	4.76E-01 *	3.66E+02 *	7.93E+00 **	3.20E+01 **	6.67E+03 **	1.14E+04 *	3.86E+01 **
Strontium-89	1.59E+01 *	1.22E+04 *	6.64E+01 **	2.66E+02 **	8.53E+03 **	3.81E+05 *	2.78E+02 **
Strontium-90	1.44E+00 *	1.11E+03 *	2.40E+01 **	9.70E+01 **	2.02E+04 **	3.46E+04 *	1.17E+02 **

174

TABLE 26
PROGRAMMATIC PRGs FOR ROCKY FLATS PLANT

Target Analyte List Chemical	Residential Groundwater (mg/L)	Residential Surface Water Swimming (mg/L)	Residential Soil (mg/kg)	Office Worker Soil (mg/kg)	Construction Worker Subsurface Soil (mg/kg)	Wading Ecological Worker (mg/L)	Soil Ecological Worker (mg/kg)
Tritium	8.82E+02 *	6.78E+05 *	1.47E+04 **	5.93E+04 **	1.23E+07 **	2.12E+07 *	7.16E+04 **
Uranium-233	2.98E+00 *	2.29E+03 *	4.47E+01 **	1.82E+02 **	2.84E+04 **	7.14E+04 *	2.18E+02 **
Uranium-234	2.98E+00 *	2.29E+03 *	4.53E+01 **	1.85E+02 **	3.09E+04 **	7.14E+04 *	2.22E+02 **
Uranium-235	2.98E+00 *	2.29E+03 *	1.73E-01 **	6.92E-01 **	1.74E+01 **	7.14E+04 *	6.92E-01 **
Uranium-238	2.98E+00 *	2.29E+03 *	4.60E+01 **	1.87E+02 **	3.33E+04 **	7.14E+04 *	2.25E+02 **

= Chemicals listed are volatile.

* = Values given are in units of pCi/L.

** = Values given are in pCi/g.

APPENDIX E
WASTE MANAGEMENT PROCEDURES

This appendix discusses in detail the procedures for handling and disposing wastes generated during Soil Remediation IM/IRA. Additional procedures may require development depending on the type of containerization and off site disposal location. These procedures will be included in the Implementation Plan or an as addendum to this document. The IM/IRA Manager will be responsible for adherence to the procedures and the proper handling in the field of all wastes generated.

E.1 GENERAL REQUIREMENTS FOR MANAGING RADIOACTIVELY CONTAMINATED WASTE

E.1.1

Radioactively contaminated waste must be packaged in accordance with procedures:

1. WO-4034, Radioactive Waste Packaging Requirements
 - This document outlines specific requirements for packaging solid radioactive waste for storage, transportation, and disposal.
2. WO-1100, Solid Radioactive Waste Packaging Inside the PA
 - This procedure provides specific step-by-step instructions for the packaging of solid radioactive waste which is generated inside of the Protected Area.
3. WO-1101, Solid Radioactive Waste Packaging Outside the PA
 - This procedure provides specific step-by-step instructions for the packaging of solid radioactive waste which is generated outside of the Protected Area.
4. WO-1102, Waste/Residue Traveler Instructions
 - This procedure provides specific step-by-step instructions for completion of the Waste/Residue Traveler which is required for every drum or container of radioactive waste generated.

E.1.2

Management of radioactively contaminated waste must be in accordance with either the Low Level Waste Management Plan or the TRU Waste Management Plan, whichever is applicable.

E.1.3

Generators and verifiers of radioactively contaminated waste must have successfully completed Solid Radioactive Waste Generator Training/Qualification and possess a current Waste Generator Qualification Badge.

E.1.4

All radioactively contaminated waste must have an assigned process number either through a Waste Stream and Residue Identification and Characterization (WSRIC) Building Book or Non-Routine Waste Origination Log. The process number must provide traceability to supporting waste characterization documentation.

E.1.5

All sampling and analysis of radioactively contaminated waste for waste characterization information must be executed in accordance with an approved sampling and analysis plan which complies with the requirements of Section 4.0 of NVO-325, Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements.

E.1.6

Sampling and analysis characterization (i.e., analytical knowledge) will be necessary in all cases where process knowledge cannot be fully substantiated and documented.

E.1.7

In general, waste should be fully characterized (either by process knowledge, analytical knowledge, or a combination of both) prior to being generated and packaged into waste containers.

E.2 HANDLING OF WASTE FROM SOILS IM/IRAs

The contaminated soil (containing low-level radioactive, low-level mixed, or hazardous materials) removed from the IHSS during the IM/IRA will be containerized at the IHSS in drums (55-gallon or 30 gallon), in half-boxes or specially-modified bins, depending on the expected volume of wastes with the goal of minimizing the number of containers.

E.2.1 Receiving and Documenting Containers

The process for receiving the necessary containers for containerizing the contaminated soil is identified below:

1. The IM/IRA Manager will contact EG&G Waste Operations which will specify the type of container required.
2. The site team will contact the EG&G project manager (at least five days before the containers are needed) who will direct the site team to the appropriate drum distribution area.
3. EG&G will issue DOT-approved, open-top (removable-top) containers. The containers will be marked "ENVIRONMENTAL MATERIAL PENDING ASSESSMENT".
4. EG&G will assign a sequential number and two-letter site team identifier for each container issued.
5. Upon the receipt of a container the site team will begin to fill out Form FO.10A - Container Field Log Form. The site team will use this form to track each container until it is returned to Waste Management.

E.2.2 Containerizing Contaminated Soils and Required Documentation

Below are the procedures for properly containerizing contaminated soil and developing the necessary documentation.

1. For 55-gallon drums, the site team will insert a black rigid liner and round-bottomed bag into the bottom of each drum. For 30-gallon drums, the site team will insert two five-mil plastic liners.
2. Absorbent materials will be added to the waste, if required, to control free liquids. The quantity of sorbent material added will be sufficient to absorb a minimum of twice the calculated volume of liquid. When significant differences of temperature exist between the generating site and the disposing site, provisions for additional absorbent materials shall be made for affected waste forms.
3. Soil will be placed into each drum or container to a level approximately two inches below the top of the liner.
4. The site team will not commingle soil with any other environmental material, including personal protective equipment, in any container.
5. After filling the drums, the site team will seal each container. The site team will then place a temporary sample custody seal on the bolt or the ring assembly until an EG&G representative can secure a permanent wire custody seal. In addition, an Environmental Management label will be placed on each drum.
6. The site team will then clean the outside of the container if it is dirty, and mark the drum with (1) the associated field location identifier, (2) the word "Soil", (3) the depth interval from which the soil was extracted, (4) sample number(s) of associated composite soil samples taken from the location, (4) the date the container was filled, and (5) (above each drum label) the words "Free Liquids" or "No Free Liquids". These markings will be

legible, the characters will be approximately two inches in height, and will be written on two opposite sides and top of each container.

7. These markings, plus the signature of the person who filled the container, will also be recorded on each drum's Drum Field Log Form. Within one week after a container has been filled, the site team will forward a copy of the completed Field Log Form to the EG&G project manager.
8. A site team Health and Safety Specialist that has been approved by Radiological Engineering will conduct a radiation screening test on the exterior of each container before it leaves a potentially radiologically contaminated work area. If necessary, the remediation site team will decontaminate the exterior of containers, as discussed below.
9. The site team will place Gray drums on leveled wooden pallets and bind the drums at the site with 1¼ inch steel bands. The site team will place a maximum of three 55-gallon drums or four 30-gallon drums on each pallet.

E.2.3 Transfer of Responsibility of Containers to Waste Management

Below is the process for the transfer of responsibility of the drums from the remediation site team to EG&G.

1. The site team will contact the EG&G Waste Operations and Environmental Management that containers are ready for storage or disposal. The containers will remain at the site until Waste Operations notifies Environmental Management that space is available at Waste Operation's transfer/storage area.
2. Waste Operations will notify Environmental Management when space is available for the containers at the transfer/storage area and at that time the site team will be directed to transport the containers to the designated transfer/storage area. Before transporting the containers, the site team will complete the Waste Residue Traveler documentation (RF-47386). In transporting the drums, the site team will follow all applicable procedures

specified in the On Site Transportation Manual including the use of trucks with enclosed sides.

3. At the storage/transfer area, the site team will present two duplicate copies of the completed Drum Field Log Forms and other required documentation (see Section E.1.4 below) to the receiving EG&G Waste Operations personnel. The receiving EG&G personnel will inspect the containers and if the containers pass inspection, the receiving personnel will sign both copies of the Log Forms. The site team will retain one signed copy of the Log Forms for the project files.

At this point, custody of the containers will pass from the site team to EG&G Waste Operations.

E.2.4 Documentation

E.2.4.1 Form FO.10A - Field Log Form

A permanent record of the site team's implementation of these container receiving, labeling, and handling procedures will be kept by the site team on Form FO.10A - Field Log Form as described above. The site team will check and update these forms, as necessary, each time the containers are handled by the site team.

E.2.4.2 Form FO.10B - Inspection Form

The site team will conduct weekly inspections of all containers it has been issued until those drums have been returned to the custody of EG&G. The site team will record all inspections on Form FO.10B - Inspection Form. The purpose of such inspections is to maintain the integrity and labeling of each container. The site team will immediately report any damage or problem that may compromise the integrity of a container(s) to the EG&G project manager or designated EG&G representative.

E.2.4.3 Form FO.10D - Composite Log Form

The site team will complete Form FO.10D - Composite Log Form to record the site locations and which containers were used for the drawing of composite samples. Composite samples are taken and analyzed in order to accurately characterize the waste constituents of the excavated soil in accordance with applicable Waste Acceptance Criteria (WAC) of the off site disposal location.

E.2.4.4 Digital Data Files

The site team will maintain a simple structured data base (e.g., Lotus or Excel spreadsheets) that contain the following information from Forms FO.10A and FO.10B (see above):

- Container identification numbers
- Container fill dates
- Locations of extracted soils
- Project identification
- Analytical chemistry sample identification numbers (including radiological screens)

The site team will maintain this digital information quarterly and submit the data on floppy diskette to the EG&G RFEDS representative and the Operable Unit project manager with annotation (in the digital file and on the diskette labels) that identifies the nature of the data.

E.3 MANAGING FIELD DECONTAMINATION WASTES

This section discusses the procedures that the site team will follow to properly decontaminate equipment in the field and dispose of the water generated during decontamination. It also will discuss the proper disposal of personal protective equipment.

E.3.1 Field Decontamination of Equipment

The site team will reduce the contamination on equipment and container surfaces in the field in an effort to reduce overall contamination of these items before they are moved from the work site. To accomplish this decontamination, the site team will follow all applicable procedures, including documentation requirements, as specified in Field Operation Procedure FO.3 - General Equipment Decontamination and Field Operation Procedure FO.4 - Heavy Equipment Decontamination.

In general, the site team will implement the following measures at the work site to reduce contamination levels on equipment and drums.

1. Scrape or brush off gross contamination while in the exclusion zone.
2. Remove the item to be decontaminated from the exclusion zone and wash it with a laboratory grade detergent and tap water. A brush will be used to remove residual particulates.
3. Rinse the item with tap water.
4. The item may now either be wrapped in plastic to prevent cross-contamination or be reused immediately.

E.3.2 Handling of Decontamination Water

The site team will follow the procedures specified in Field Operation Procedure FO.7 - Handling of Decontamination Water and Wash Water to properly dispose of any water generated during field decontamination activities.

Generally, the site team will implement the following procedures.

1. Contain decontamination water in Gray 55- or 30-gallon open top (removable top) drums or environmental liquid containers. The site team will receive, document the use of, and fill these drums in accordance with applicable requirements specified in Field Operation Procedure FO.10 - Receiving, Labeling, and Handling Environmental Materials Containers.
2. Mark liquid containers with the words "NONPOTABLE PENDING ANALYSIS".
3. Secure container lids and transport containers to the main EG&G decontamination facility in a truck with enclosed sides.
4. Empty the contents of containers at the decontamination facility in the area designed for environmental liquids disposal.
5. After containers are emptied, decontaminate them in accordance with Field Operation Procedure FO.3 - General Equipment Decontamination.

The site team will dispose of decontamination water at least once each day that such water is produced, regardless of contamination levels, or more than once a day depending on field conditions (e.g., heavy mud, or organic or radioactive contamination).

E.3.3 Disposal of Personal Protective Equipment

The site team will dispose of potentially contaminated personal protective equipment (PPE) in accordance with Field Operation Procedure FO.6 - Handling of Personal Protective Equipment. Specifically, the site team will implement the following procedures.

1. Workers wearing PPE will establish a personnel decontamination line in accordance with the site-specific Health Safety Plan and will double-bag their PPE in 3 mil plastic bags.
2. The last person in line will continue to wear respiratory protection (if required), will don a fresh pair of gloves, and will remove the plastic bags containing the disposed PPE.

This worker will compress the bags in a downwind direction and seal the bags with duct tape. If possible, individual bags will be combined into clear 3 mil plastic bags and sealed with duct tape.

3. Respirator cartridges and gloves will also be placed inside a plastic bag, sealed, and marked.
4. The site team will note the following information on adhesive labels and affix those labels on all the double 3 mil bags: the characters "PPE", the associated site location designation, the date, and either the words "RADs NOT DETECTED" or "RADs DETECTED (# of counts detected)", as appropriate.
5. The site team will transport the plastic bags to the Potentially Contaminated cargo container in the contamination reduction zone located east of the decontamination pad. The site team will not commingle bags containing potentially contaminated PPE with bags containing non-contaminated PPE. At this location, the site team will turn the bags over to the receiving EG&G representative. The site team will fill out an accompanying COC in duplicate. When the PPE is turned in, the EG&G representative will sign the COC and return one copy of the COC form to the site team.

Action Levels for Residential Scenario (Water and Soil) Based on a 1×10^{-6} and 1×10^{-4} Risk

Radionuclide	Oral Slope Factor	External Slope Factor	Tap Water (pCi/L) (a) 1×10^{-6} Risk	Tap Water (pCi/L) (a) 1×10^{-4} Risk	Soil (pCi/g) (b) 1×10^{-6} Risk	Soil (pCi/g) (b) 1×10^{-4} Risk
Americium-241	2.40×10^{-10}	4.90×10^{-9}	8.15×10^{-2}	8.15×10^0	3.17×10^0	3.17×10^2
Cesium-137	2.80×10^{-11}	0.00×10^0	6.99×10^{-1}	6.99×10^1	2.72×10^1	2.72×10^3
Plutonium-239	2.30×10^{-10}	1.70×10^{-11}	8.51×10^{-2}	8.51×10^0	3.31×10^0	3.31×10^2
Plutonium-240	2.30×10^{-10}	2.70×10^{-11}	8.51×10^{-2}	8.51×10^0	3.31×10^0	3.31×10^2
Radium-226	1.20×10^{-10}	1.20×10^{-8}	1.63×10^{-1}	1.63×10^1	6.34×10^0	6.34×10^2
Radium-228	1.00×10^{-10}	0.00×10^0	1.96×10^{-1}	1.96×10^1	7.61×10^0	7.61×10^2
Strontium-89	3.00×10^{-12}	4.70×10^{-10}	6.52×10^0	6.52×10^2	2.54×10^2	2.54×10^4
Strontium-90	3.30×10^{-11}	0.00×10^0	5.93×10^{-1}	5.93×10^1	2.31×10^1	2.31×10^3
Tritium	5.40×10^{-14}	0.00×10^0	3.62×10^2	3.62×10^4	1.41×10^4	1.41×10^6
Uranium-233	1.60×10^{-11}	4.20×10^{-11}	1.22×10^0	1.22×10^2	4.76×10^1	4.76×10^3
Uranium-234	1.60×10^{-11}	3.00×10^{-11}	1.22×10^0	1.22×10^2	4.76×10^1	4.76×10^3
Uranium-235	1.60×10^{-11}	2.40×10^{-7}	1.22×10^0	1.22×10^2	4.76×10^1	4.76×10^3
Uranium-238	1.60×10^{-11}	2.10×10^{-11}	1.22×10^0	1.22×10^2	4.76×10^1	4.76×10^3

(a) Ground water screening action level calculated using Subpart S exposure assumptions (70 kg adult ingests 2 l/day water, 365 days/year over 70 years).

(b) Soil screening action levels calculated using Subpart S exposure assumptions except for age-adjusted soil ingestion factor (3,600 mg-yr/day) (EPA 1991).